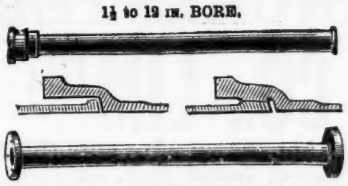
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXII. No. 1594.] LONDON, NOVEMBER 28, 1893. [45TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.



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ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

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Oxide Paints, Oils, and General Stores for Gas and Water Works.

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Lanemark Coal Co.,

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LANEMARK CANNEL

AND GAS COALS.

Quotations and Analysis on application to

LANEMARK COLLIERY,

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Shipping Ports: All the principal Scotch Ports.

THE "C" BURNER.

NEW HIGH-POWER GAS-LIGHT.

INCANDESCENT GAS-LIGHT SYSTEM.

Consumes
3¾ cubic feet per hour.

Gives a light of
70 to 80 candle power.

Brilliant Light.

Perfectly Steady and
Noiseless.

Smokeless.

Reduced Heat.

The Ordinary Burner, with Special Globes, is suitable for Lighting Private Houses, Public Houses, Restaurants, Shops, &c.

Special Lamps constructed for Outside Lighting and Street Lighting; and Large Clusters of Lights made for Lighting Halls and large Areas from one centre.

Can be attached to any Gas-Fittings.

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Taking Gas at 3s. per 1000 cubic feet and Electric Light at 8d. per Board of Trade unit, the "C" Burner will produce an equal amount of light at **One-eighth the cost of Electric Light.** This cannot be disproved.

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Material and Workmanship of the best.

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CO_2 AND TAR-EXTRACTING WASHERS;

SCRUBBERS, on most improved principles, with planed joints.

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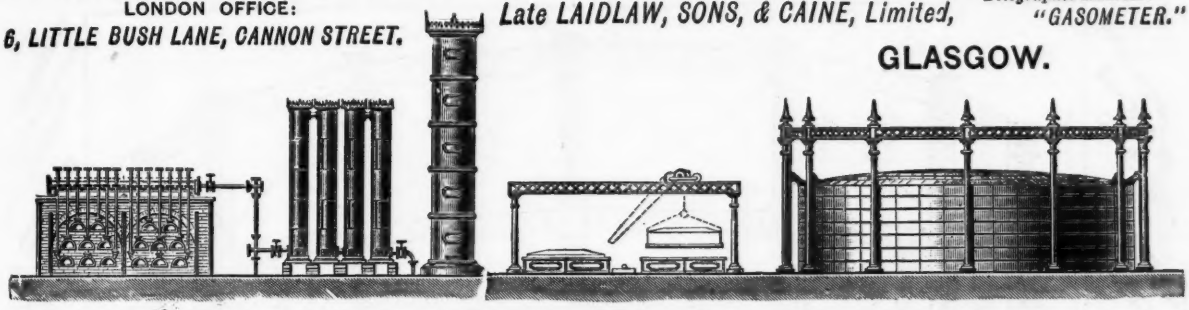

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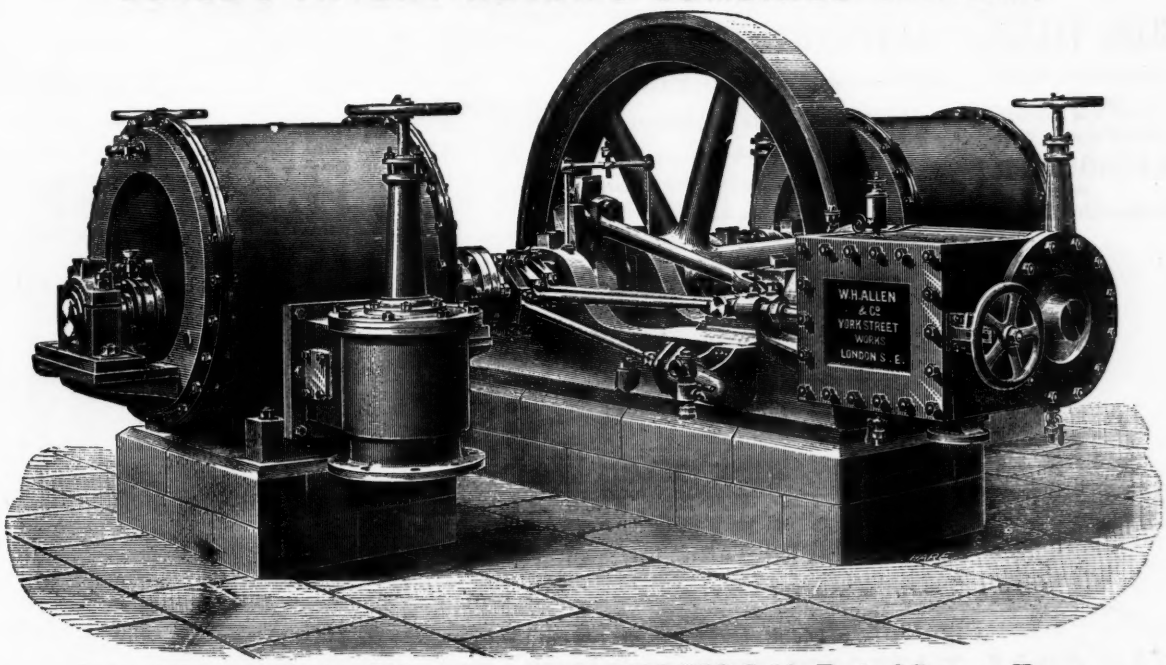

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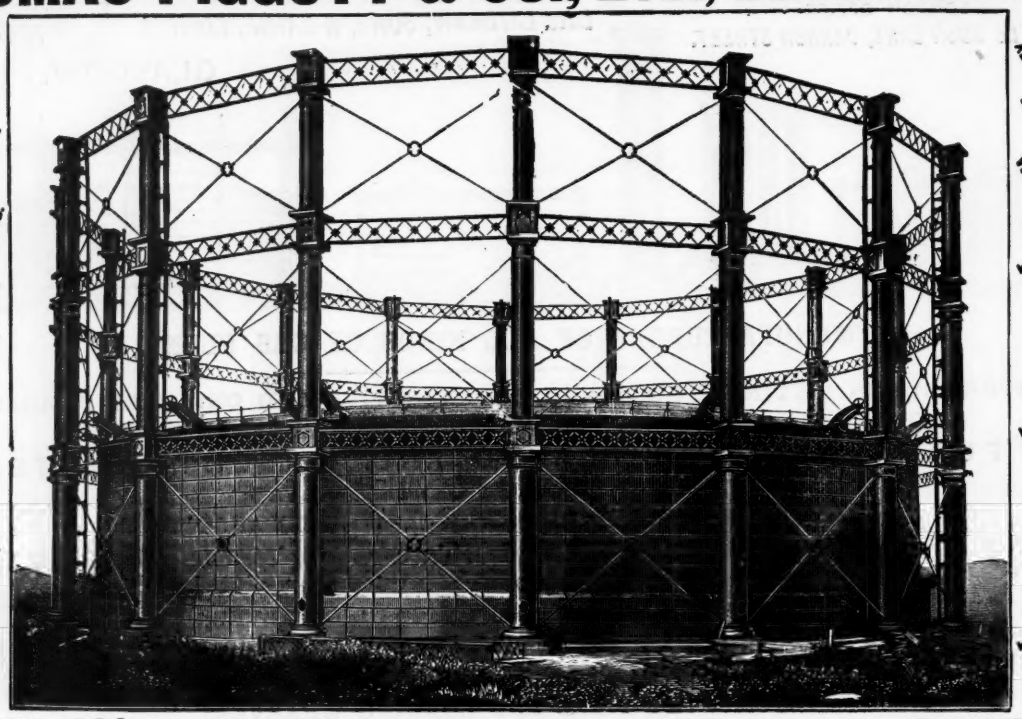

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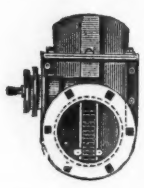
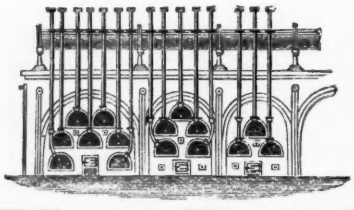
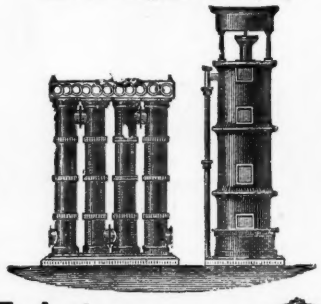
for working Purifiers.

Also Bye-Pass & Stop Valves.







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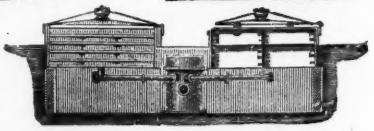

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SINKING BOREHOLES *and* WELLS;
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GASHOLDER TANKS; *and* EVERY REQUISITE *for* GAS *and* WATER WORKS,
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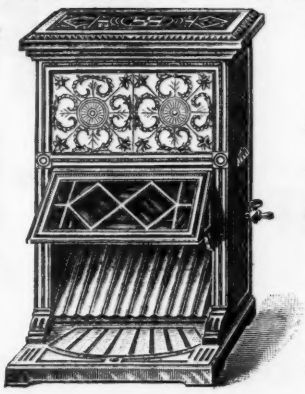

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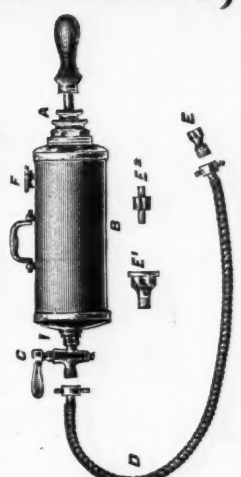

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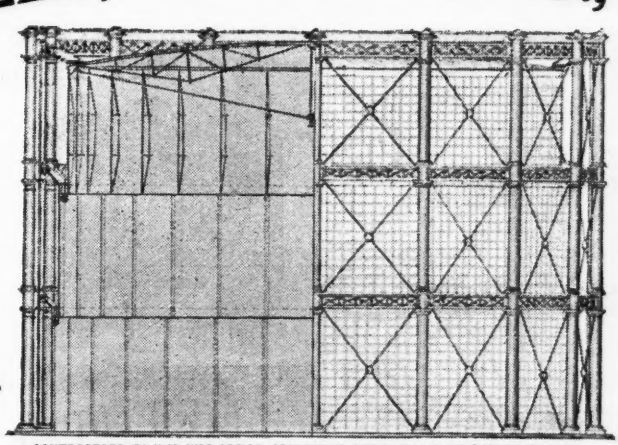

LIVESEY WASHERS,
STATION METERS,
STATION GOVERNORS,
IRON & STEEL ROOFS,
WROT & CAST TANKS,
RETORT-FITTINGS.

CONTRACTORS TO H.M. WAR OFFICE, ADMIRALTY, AND IRISH LIGHTS COMMISSIONERS.

THREE-LIFT GASHOLDER, 124 FEET DIAMETER.
EACH LIFT 28 FEET DEEP.
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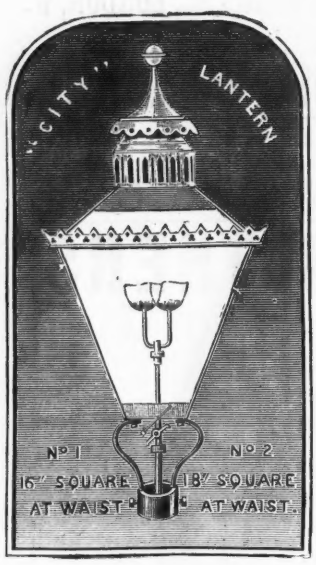
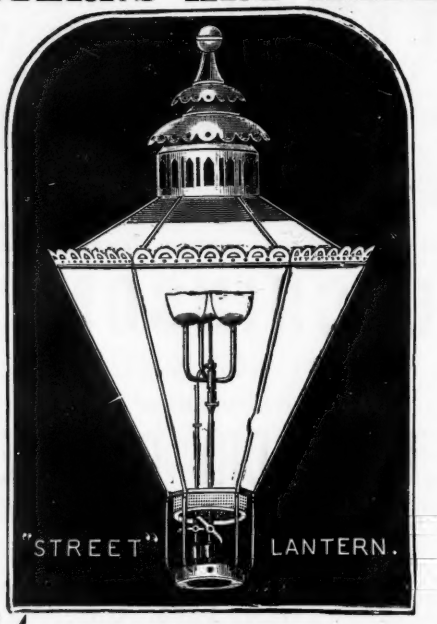
From 30 to 1100 Candle Power.

They are suitable for Gas of every Candle Power.

ALL OUR LANTERNS ARE MADE OF COPPER.



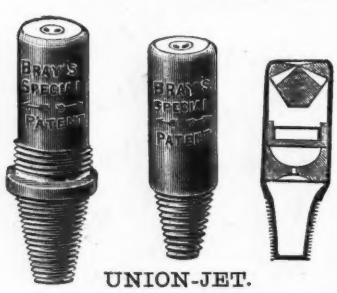


BRAY'S "SPECIAL" BURNERS

Are the best in the Market for general use, and are very moderate in price.

It is not unusual to see the ordinary Burner yielding less than half the light that Bray's "SPECIAL" would yield with the same consumption of Gas.

Gas Managers should try them on consumers' fittings; and they would see at once how to compete more effectively with the Electric Light.



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BATSWING.

GEO. BRAY & CO., GAS LIGHTING ENGINEERS, LEEDS.

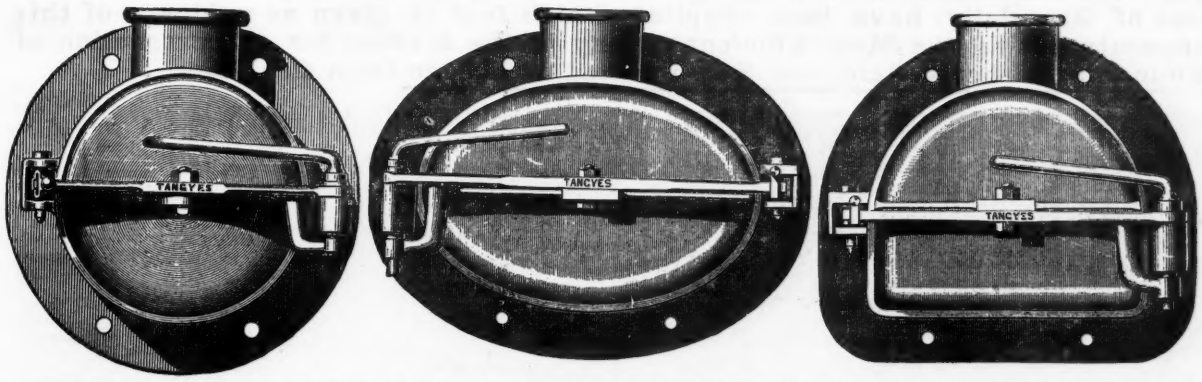
TANGYES LIMITED, CORNWALL WORKS, BIRMINGHAM.

AND AT

LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, MELBOURNE, JOHANNESBURG, BILBAO, ROTTERDAM, & CALCUTTA.

MORTON'S SELF-SEALING RETORT-LID,

With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



These Retort Lids and Fastenings are made in three forms, round, oval, and ⌂ (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these Lids are recommended to make their selection, in order to avoid cost of pattern-making, delays, &c., &c.

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NEARLY

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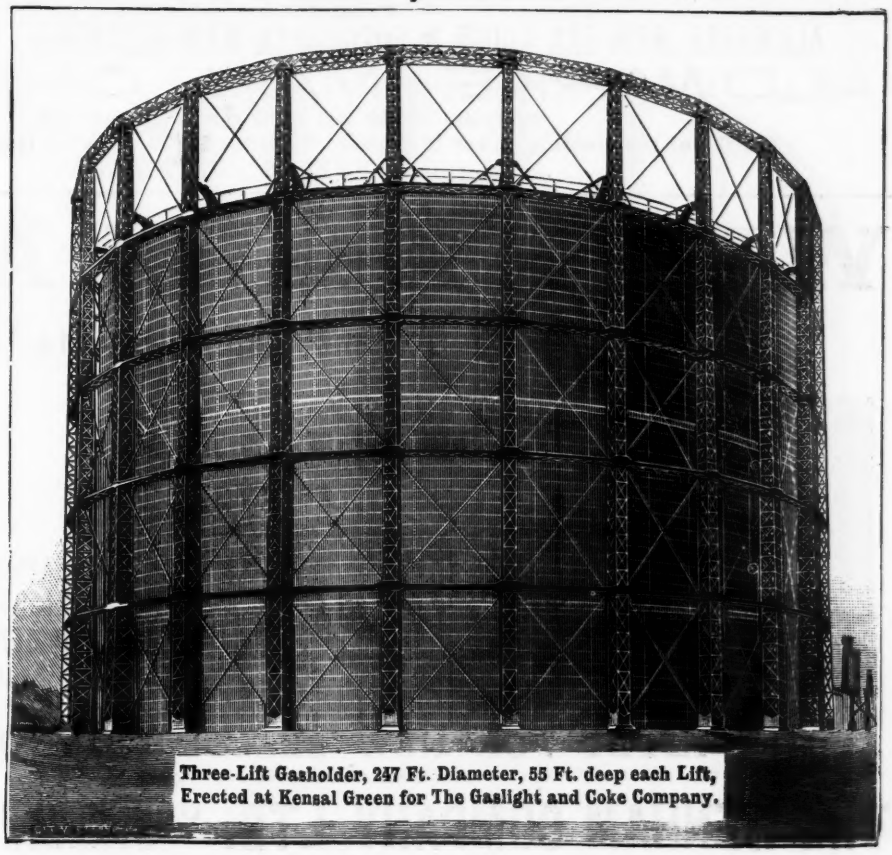


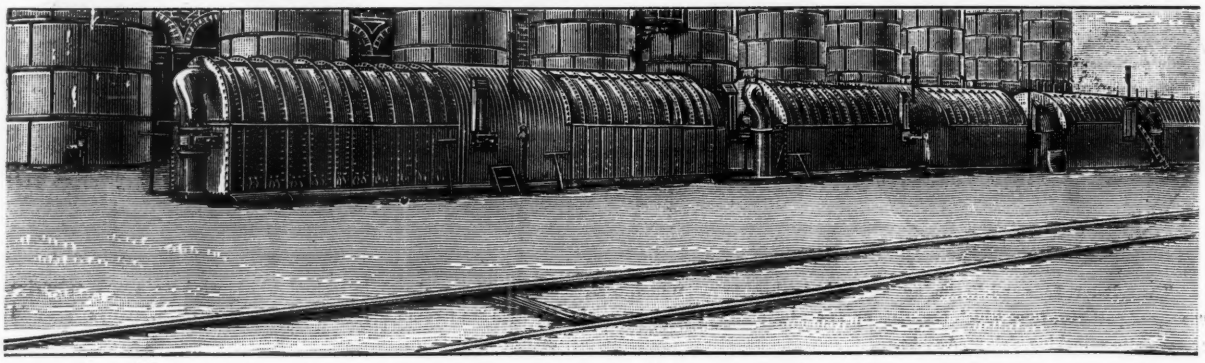
Three-Lift Gasholder, 247 Ft. Diameter, 55 Ft. deep each Lift, Erected at Kensal Green for The Gaslight and Coke Company.

KIRKHAM, HULETT, & CHANDLER, LD.,

Patentees of the

PATENT "STANDARD" WASHER-SCRUBBER.

☞ **467** of these Machines (capable of dealing with **447,807,000** cubic feet of Gas daily) have been supplied, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company has **27** of these Machines in use, and Two more, each for 3½ million feet per day, are in course of construction for them. They are also in operation at a great number of Gas and other Works in this Country and abroad.

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ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
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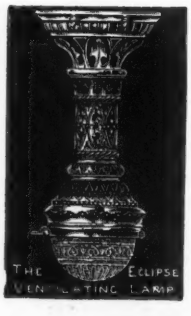
With Recent Improvements.



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STILL THE BEST REGENERATIVE LAMP.

20/-

CHEAPEST! MOST ORNAMENTAL AND RELIABLE!

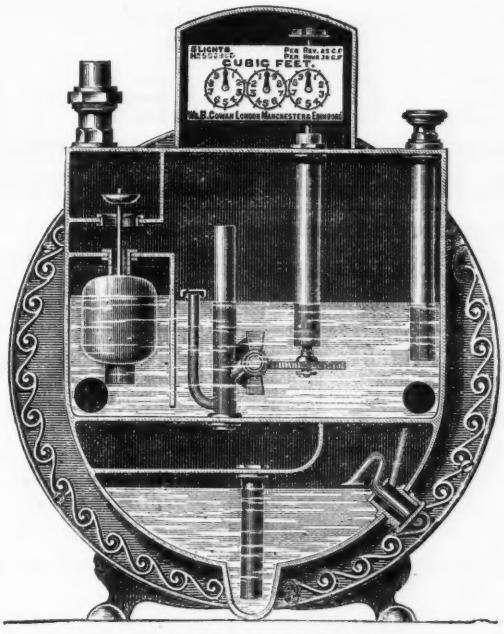
APPLY FOR NEW SEASON'S CATALOGUE.

THE WENHAM COMPANY, LTD. UPPER OGLE STREET, **LONDON, W.**

W. & B. COWAN'S WET METERS

IN TIN AND CAST-IRON CASES.

A Speciality in our Wet Meters is **THE WARNER AND COWAN DRUM,** which ensures accurate registration, independent of the height of the water-line; whereas, in the ordinary Wet Meter, the evaporation of water tends to make the registration show to the prejudice of the Gas Company.



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Another important feature in our Wet Meters is **WM. COWAN'S PATENT SYPHON OVERFLOW,** by which, when watering the Meters, the water-line is attained **with rapidity, certainty, and exactitude;** and it is impossible for any water afterwards to find its way into the waste-box.

THESE METERS STAND HIGH PRESSURES.

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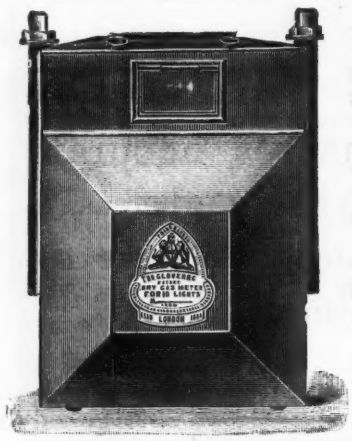
LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
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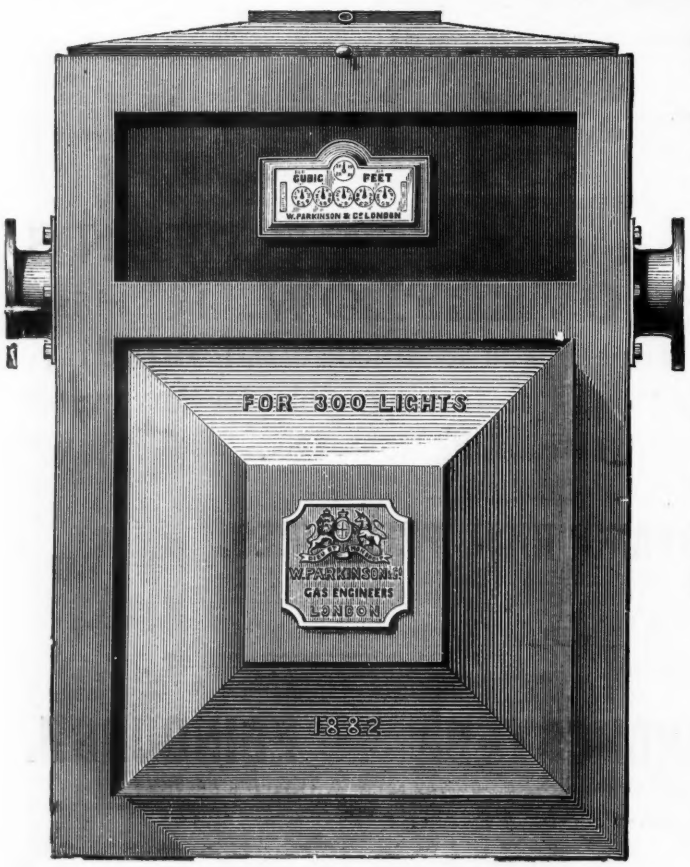

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 28, 1893.

The Oxy-Oil Gas Process before the Southern Association.

THE Southern District Association of Gas Managers have held many interesting meetings since the formation of the society; but, in the phraseology of the day, last Thursday's must certainly be classified as a "record" for a November gathering of the Association. The attendance of members was large, and there was a very strong contingent of visitors—a circumstance which pointed to there being something special in the programme, more particularly as many of these gentlemen appeared to be utter strangers to the ordinary members. The truth of the matter was that, according to the agenda, Dr. Leonard T. Thorne was to read a paper on "Oxy-Oil Gas (Tatham's Process), and "its Use for Purposes of Enrichment;" and seeing that the exploitation of this process is not a "missionary enter-"prise," but very much a matter of business, it was only natural that a number of the gentlemen who are interested otherwise than technically in the subject of the paper should have gathered to support the reader. Moreover, it was well known among the members and outside the Association that the paramount advantages of the oxy-oil process of coal-gas enrichment are not granted by everybody who has had occasion to look into this project; and consequently there was every reason to expect that what had already become a subject of controversy in gas engineering circles would supply interesting, and perhaps exciting matter for the Transactions of the Association. Hence Thursday's crowded room at the Holborn Restaurant. But the result was hardly up to the general expectation. Dr. Thorne's paper was a clever production—far cleverer, indeed, than can be realized by anyone who has not studied the subject in the earlier stages of its development. The author did all that man could do in the position in which he was placed; but to say that he carried his side of the controversy as to the utility of the oxy-oil gas process of enrichment one iota farther towards a triumphant termination, would be to utter the thing that is not true. This judgment proceeds simply on a review of what Dr. Thorne had to do, and what he actually did—not overlooking what has been done in this connection by others. It would be an affectation to regard this paper as standing alone, ignoring the position in which the oxy-oil gas process was left by Professor Lewes's public utterances, by the contemporary development of the *technique* of coal-gas enrichment, and by the article in the JOURNAL descriptive of the Huddersfield oxy-oil gas plant. If these contributions to the elucidation of the subject could be ignored, it might be feasible to take Dr. Thorne's paper for what it contains. In the circumstances, however, it must be read with even greater attention for what it omits. It would be absurd, at this time of day, to regard this oxy-oil gas scheme merely as a curious exercise in gas technics, as it was when first introduced to the British public. It is still this, and must consequently be commended to the notice of the gas manufacturer; but it is also the basis of financial operations which have already been carried pretty far, and may be opened out upon a grand scale at any moment. For this latter reason, we shall henceforth drop all pretence of looking only at the technical aspect of oxy-oil gas enrichment, and shall treat it also from a business standpoint.

If Dr. Thorne's attempted justification of the oxy-oil gas process on Thursday was meant to be the last word spoken for the confusion of the unbelievers in it, the effort was a failure. If something more is to be forthcoming before anybody else is asked to put money into the thing, then the sooner this comes the better. For what was the sum and substance of Dr. Thorne's paper? Did it meet one of the objections that had been urged against the process in our columns as well as elsewhere? In order to answer this question, it is necessary to recapitulate the chief of these objections. Professor Lewes said some time ago, in a Cantor Lecture, and also quite recently before the Society of Engineers, that the addition of oxygen to oil gas intended to be added to a poor coal gas for the purpose of enrichment was superfluous; and we have remarked that the comparison of oxy-oil gas enrichment must be made with enrichment by the best-known rival process—naming the process of Messrs. Young and Bell as a representative one. In his paper, Dr. Thorne made no mention of this crucial comparison; but he supplied the material for it, which was promptly utilized by Professor Lewes, who showed, by a simple blackboard calculation, that the oxy-oil gas process of enrichment, as reported by Dr. Thorne, is no better than, if it is quite so good as, the Young and Bell working reported by Mr. F. T. C. Linton for the Edinburgh and Leith Gas Commission. We were sorry to observe that, in making an attempt to get out of the dilemma in which this fatal comparison had placed him, Dr. Thorne was betrayed into speaking disparagingly of Mr. Linton's work. Would it be credited, however, that this careful experimentalist

—who would in all probability be shocked if he were described as a partisan—having set out to show the value of an addition of oxygen to coal and oil gas for the purpose of enrichment, did not bring forward one statement of the result of analysis to show that there was any free oxygen in the gas at all? The paper states that "no appreciable "difference" could be detected in the carburetting results at Huddersfield, whether the oxy-oil gas was added in the stipulated proportion at the foul-gas main, or after the purifiers. Now, the proportion of oxygen in the total bulk of gas in question is, as Mr. W. A. Valon pointed out, no more than the material contained in the purifiers is capable of holding, and, as a matter of fact, does hold at Ramsgate, and wherever else pure oxygen is employed for purification only. The inference to be drawn here is consequently that there is "no appreciable difference" in the result, whether oxygen is present in the purified gas or not. Either our logic is wofully defective, or Dr. Thorne has unintentionally cut the ground from under his own feet. Of Mr. Herring's contribution to the discussion on Thursday, it is unnecessary to say much. He seemed to find the addition of oxygen needful to make his oil gas; but since other people make oil gas without it, this statement only reflects on the character of the Huddersfield oil-gas plant. He also said he preferred to take the results of carburetting with pure oil gas from some other place. He and gas managers now generally know where the information may be obtained; and the working of the oxy-oil gas process does not show very brilliantly beside it. We have not by any means exhausted the subject; but this will probably be enough about it for the present.

The Manchester District Meeting.

The Manchester District Institution of Gas Engineers met in Manchester on Saturday last—Mr. James Braddock, of Radcliffe, in the chair, in the absence of the President (Mr. W. R. Chester, of Nottingham), who was unable to attend. Mr. Braddock was elected President for the ensuing year. The principal business of the meeting was the reading of the paper by Mr. J. Chadwick, of Oldham, which appears in another column, on "The Stacking of "Coal, and Coal-Haulage Machinery." This was a very timely and useful communication; and it also served, by a little stretching of the point, to cover an interesting conversational discussion on the effect of the coal troubles upon the gas-works of the district. No gas undertakings in the kingdom have suffered more in this regard than those represented by the members of the Manchester Institution; and their experiences of the last two months are full of instruction for observers of the general conditions of gas supply. It has been shown that such ideas as those held by the late Sir W. Siemens on the subject of the advantage of locating gas-works for the supply of large towns in close proximity to a particular coal-field, are susceptible of serious qualification. It is not always beneficial for such manufactures as that of illuminating gas to be situated in the midst of a source of the raw material. This circumstance is apt to lead to a "hand-to-mouth" system of getting in supplies, which answers well enough for ordinary occasions, but is liable to break down in times of emergency. It would look very ridiculous for a gas-works surrounded by collieries to store coal largely; but the last month or two have shown that a gas manager may walk upon seams of coal for miles round his works, and not be able to get a ton of it. It is quite impossible for a gas manager so situated to protect himself, by storing coal, from such a local famine as that which has devastated the Manchester district since August. No commercial undertaking or municipal establishment can be reasonably expected to be prepared at all times for an emergency that may only occur once in a generation. All that can be done is to take every rational precaution; and the case of gas supply is a matter in which this may well mean preparedness to spend, in the effort to keep things going at a pinch, more money than a mere commercial enterprise could bear. But if, after all, there is no coal to be had, the gasholders must necessarily stand empty. Gas managers cannot do impossibilities, any more than other men. The utmost to be expected of them is that the range of the impossible shall be restricted to the narrowest limits by their foresight and the providence of their employers. It can never be wholly eliminated; and when the blow falls, the only course is to bear it patiently.

The Sanitary Aspect of Gas-Stoves.

In the current number of the *Lancet* there appears the third part of the report of the Special Analytical Sanitary Commission on Smoke Prevention and Perfect Combustion, which contains a mass of information respecting the performance of gas fires and stoves. We shall on a future occasion deal more fully with this really important work of our medical contemporary; but we desire for the present to draw our readers' attention to it, and to thank the organ of the medical profession for the full and frank way in which this investigation has been conducted, and for the splendid testimonial it supplies to the capabilities of gas when used as fuel for domestic purposes. We hope the *Lancet* will employ the data now rendered available in support of the cause that has been advanced in these columns—the popularization of gas as an agency for the mitigation of some of the evil effects which the enormous extension of the "flat" system in London must otherwise produce upon the atmosphere of the Metropolitan area. It will be a great thing to have the medical profession on our side; and if the architects and owners of town property can only be aroused also to a sense of the gravity of the danger by which London is threatened, much may be done in the way of aërial sanitation. The present *Lancet* article has been prefaced by others dealing with the combustion of solid fuel, and explaining the principles according to which fire grates and stoves should be constructed. It appears that during the past year the Commissioner for our contemporary has studied closely the capabilities of the gas supply of London, as represented by the undertaking of The Gaslight and Coke Company, for satisfying the immediate and future requirements of the Metropolis in the matter of gaseous fuel. The result of his prudence in putting himself in the safe hands of the engineering staff of the Company is shown in the general correctness of his observations and conclusions. The scale upon which the gas supply of that portion of the Metropolitan area served by the Company is necessarily carried on, seems to have considerably impressed the inquirer, as was only natural; and he had no difficulty in recognizing that "even the "existing plant, both manufacturing and distributing, is "equal to the increasing requirements necessitated by "the application of gas for purposes other than those of "lighting." When the Commissioner came to investigate the gas heating appliances actually at the command of the consumer, he was impressed favourably on the whole. Not being an engineer, he occasionally drops into a slipshod way of expressing himself on the subject of what he calls "fuel," which term includes for him such things as clay balls, iron, and asbestos; but this theoretical error does not vitiate his tests of stove performances. For the interests of the gas industry, it is of chief importance to record that this altogether disinterested inquirer finds "manifold advantages" in gas as compared with coal fires. He says: "None will deny the convenience of the "system" of heating rooms by gas. Upon the point of comparative expense, he admits that at first sight gas as fuel would appear to compare unfavourably with coal in regard to cost; but "when all the factors (cleanliness, "convenience, manipulative advantages) are taken into "account—when the *pros* and *cons* are considered in "minute detail—it is probable that, used rationally, gas "runs coal very closely even on the scorce of expense. "But one thing is certain—namely, that the universal "adoption of gas as a source of heat would eventually "lead to the complete abatement of the smoke-laden and "unhealthy fogs which are a bane and a reproach to the "most important city in the world." On the subject of cooking by gas the report is equally commendatory.

Free Labour Appealing to the House of Lords.

The Employers' Liability Bill has been sent up to the House of Lords with a parting kick from Mr. Chamberlain, who said in his trenchant speech on the third reading in the Commons that "it is a mischievous Bill both in "those things it does, which it had better have left undone, "and in leaving undone many things which it would have "been much better if it had done." The whole speech is excellent reading, instinct with actuality, and plentifully furnished with facts supplied by firms like Chances and Tangyes, whose employees, like the railway men, ought surely to be credited with knowing what is good for themselves. The Government position in this matter is perfectly intelligible, if it is neither sound nor dignified. They

have accepted the lead of Mr. John Burns and the mouthpieces of the New Trade Unionism. These men are at "daggers drawn" with all employers of whose people they cannot make tools; and they are set upon breaking down, by the help of the Government, the main safeguard erected by good firms between their men and the agitator class. The Government have yielded to the pressure of the Trade Union vote, which they believe to be controlled by John Burns and his allies. It is more than likely, however, that this estimation of the forces controlling the issue may be erroneous. He told the House that none of his constituents had spoken to him against the Bill; but this has since been explained to mean that he declined to listen to them. Many thousands of workmen have declared themselves, both by ballot and petition, in favour of their own means of accident insurance; yet the Government have dismissed their prayer at the instigation of John Burns, and in the hope that he and his party will "see them through." Consequently, the rejected ones have gone to Lord Salisbury. It can hardly be regarded in Government circles as a satisfactory result of the acceptance of the Trade Union lead, for 100,000 working men, including among them those admirable specimens of the order upon whose faithfulness in the discharge of their duties the maintenance of the railway and gas supply services so largely depends, should have been driven to ask help from the House of Lords. Who is John Burns or Keir Hardie to these men? The curious part of the present *imbroglio* is that nobody wants to stop the way of the Bill as a whole; and that the Government should be so stubborn in desiring to override the wishes of so many men whose chief offence is their refusal to have anything to do with John Burns, is doubtless a testimony to the strength of the personal influence of this personage, but is no sign of wisdom. With all his force of lung, and his posing as a "Heaven-sent" leader of Labour, John Burns has made a good many blunders in the course of his warfare against employers and free workmen. If he should add to these the culminating distinction of landing the Government in disaster, by alienating from the Party so much voting strength as was represented in the deputation to Lord Salisbury, he will stand convicted the greatest political muddler of his time.

A Russo-American Oil Ring.

Once more the ominous threat of a combination of the Russian and American petroleum interests has been uttered; and the Scotch shale oil producers are pricking up their ears at the sound of dearer petroleum, which may put them once more in the way of earning a living profit. Whether there is any substance in these rumours of a Russo-American petroleum "ring" remains to be proved; but the very suggestion goes to show that selling oil in England at the prices that have recently ruled in this trade, is not a very profitable proceeding, and therefore that no noteworthy reduction upon these rates is to be looked for. It is difficult to believe that a Russo-American petroleum "ring" could be formed at all; the circumstances of the two parties to such an arrangement being so widely different. Doubtless the Standard Oil Company would like to obtain control of the Russian oil regions; but if they were to succeed in effecting such a gigantic operation, the next thing they would do would be to shut the Russian product out of the European markets, which would hardly suit the Muscovite "book." It has been abundantly shown that there is in England an almost limitless demand for petroleum—at a price; but this question of price dominates the trade. Unless a market can be found for the low-grade oils, moreover, it ceases to be profitable to produce refined oils and naphthas. The Standard Oil Company have at home a market for their low-grade oils, which does not exist in Russia. Altogether, it is inconceivable that Russia could by any scheme be made to deprive itself of the advantages accruing from such a gift of Nature as the native petroleum supply, for the sake of American interests; and it is very certain that any "ring" in which the American producers would agree to join would be framed in their own exclusive interest, and would last just so long as it might serve their own purposes. The Russian bear and the American eagle have always cherished a sentimental kind of regard for one another; but we cannot picture them as a serviceable team for an oil-waggon.

WATER AND SANITARY AFFAIRS.

The "Memorandum" drawn up by Mr. Bassett Hopkins at the request of the Water Committee of the London County Council, for the purpose of showing the present position of the Council in relation to the question of the water supply, is remarkable as endeavouring to establish a new point of departure, entirely distinct from the report of the Royal Commission. The text of the "Memorandum" was published in the Journal last week. It will be seen therefrom that Mr. Hopkins asserts "the "comparative narrowness of scope of the inquiry which "has just been completed." It was certainly narrow enough to exclude a number of very strange and impracticable ideas which we find propounded by Mr. Hopkins; but the result was sufficient to show that London had enough good water at its command for the next forty years, if not for a yet longer period. Mr. Hopkins is not satisfied with forty years; and he fears a water famine about the year 1931. A careful perusal of the report might show that he need have no apprehension of such a calamity. But he is at issue with the report, though he says he is not. In his opinion, the report is not the outcome of an "all-embracing investigation;" and he fears some very mischievous consequences because people fail to see this defect. They think the question settled, while he looks upon it as the very reverse. To be assured that the water is good, and that there is plenty of it, would make ordinary people reasonably contented, even though they found they had to pay for it, and could not get it for nothing. But Mr. Hopkins cannot be happy—and we suppose his Progressive brethren are of the same mind—unless the supply is in the hands of the London County Council. His lot has fallen on hard times. He has small faith in the Thames Conservators, present or to come. They will be selling too much water to the Companies, and getting too much money for it, none of which will go to enrich Spring Gardens. There is a risk that Parliament will feel itself under the necessity of giving the Companies enlarged powers, so that they may construct new works and keep up a proper supply. Mr. Hopkins and his Committee—with, no doubt, a numerous following in the Council—view the prospect with dismay. Cannot the Council have some finger in the pie? If the "Memorandum" fairly represents the Council, they are ready to do anything, and submit to anything, so that they may but dabble in the water supply. They might construct the works themselves, and sell to the Companies the additional quantity of water that is wanted; or they could lend money to the Companies, or take shares, or become Directors, or do any imaginable thing which might help them on towards that glorious consummation when the water supply will be all their own. They intend to look further into the chalk of the lower Thames basin, to see what water there is in it; and they are going to have additional gaugings of the river, as though what had been done for years past was not enough. They are ready to buy the existing water-works, if they can only get them at their own price; and they think they might have a "purchase clause" put into the Companies' Bills, after the fashion of the Tramways Act. Verily, the report of the Royal Commission must "pale its ineffectual fires" in contrast with a "Memorandum" from a Committee of the County Council.

The Bill to be brought into Parliament next year by the East London Water Company corresponds in a great degree to the evidence given before the Royal Commission by the Company's Engineer, Mr. W. B. Bryan, M.Inst.C.E. It proposes the construction of two additional storeage reservoirs, and the enlargement of a third. One of the new reservoirs is to be on the confines of Tottenham and Walthamstow, and is to be formed by means of an embankment or retaining wall round the entire area appropriated to this purpose. The second reservoir is to be constructed in a similar manner; its situation occupying certain parts of Tottenham, Walthamstow, and Hackney. The provision of the third reservoir is to consist in the enlargement of one already existing, and spoken of before the Royal Commission as the Race Course reservoir. The capacity of this reservoir is to be increased by adding 9 feet to the height of the banks. Mr. Bryan's evidence showed that, by means of such plans as are now proposed, a very large addition could be made to the quantity of water taken from the Lea,

without prejudicially affecting the condition of the river, or interfering with the navigation. The necessary lines of pipes in connection with the reservoirs are to be provided for in the Bill. Power is sought to raise further money, not exceeding £500,000 cash in the whole, by the creation of debenture stock. The East London Water Bill, which the House of Commons impetuously rejected on the motion for the second reading in March last, proposed the same amount of debentures that is now contemplated; and it was then explained that £140,000 of this was required for the laying of new mains. The Bill was thrown over by a small majority, in which the Irish votes, whipped up by Mr. John Burns, turned the scale against the interests of the Metropolis. One plea put forth against the Bill was that it had the character of being premature, seeing that the Royal Commission had not reported. That plea can no longer be urged; and the report of the Commission is distinctly favourable to an extension of the existing works. The County Council will object, as before, that the East London Company seek to enlarge their capital account. If the Council can arrest the increase of the population, which is especially rapid in the East London district, it may do away with the necessity for enlarging the water-works and spending money; but not otherwise.

Another important scheme in connection with the water supply of London is the subject of a Bill to be brought into Parliament next year by the Southwark and Vauxhall Company. The works proposed under the Bill include a storeage reservoir having a superficial area exceeding 1½ million square feet. The capacity may be reckoned, therefore, at 270 million gallons. The locality for this extensive reservoir is partly in the parish of Sunbury, and partly in that of Hampton. There is every reason to believe that geologically the situation is a good one; the underlying stratum of clay coming at a convenient depth. The plan closely resembles that which was laid before the Royal Commission in connection with the Grand Junction Company, only in that case the site shown was higher up the river, in the vicinity of Staines. The plan so proposed had the approval of all the Companies drawing from the Thames. As at least one-fourth of the supply taken from the river flows through the mains of the Southwark and Vauxhall Company, it seems only reasonable for that Company to undertake the works they now propose. An addition to the volume of water derived from the Thames will be made available; and there will be no necessity to take water from the river in time of flood. Neither will there be scarcity in the event of drought, nor any reason to fear that the minimum flow of the Thames will be reduced below the point stipulated by the Royal Commission. In addition to the work already described, the plan includes a subsiding reservoir, to be constructed at Hampton, having a superficial area not much less than that specified for the storeage reservoir higher up, though the depth will probably be less. There will be filter-beds and an engine-house in the same locality as the subsiding reservoir. A double line of pipes is to be laid from Sunbury to Hampton, and another double line in Camberwell, where there is to be a service reservoir, extending into Lewisham. In connection with these enlarged works, power will be sought to take an additional supply of water from the Thames, beyond that at present authorized. It is clear that this is necessary to meet the increasing demand; and at the same time provision will be made to secure the flow of the river. Authority will be asked to raise the capital required to carry out the works thus proposed, of the need for which there can be no reasonable doubt.

The serious position in which the Dublin Municipal Council have been placed in regard to the maintenance of a proper water supply to the city has long been foreseen by those who have watched the masterly inactivity of that curiously constructed body. Until a fortnight ago, when the Corporation have to some extent realized the problem which has to be solved, there seems to have been no broad coherent scheme for improving the supply, and no comprehensive grasp of a difficulty which has already been allowed to take care of itself far too long. At the first of the two special meetings of the Council which we reported recently, Alderman Dillon complained of the criticism which had been "so unsparingly poured" on the Water Committee by the local press. But if the local press had not spoken out, would the Water Committee, even yet, have been roused from their extraordinary apathy? Would the people of Dublin have known the danger which threatens them; and would those members of the municipal body who are not on the Water Committee have taken the trouble to ascertain the real position of affairs? These are questions which it is not very difficult to answer; and they suggest the expediency of keeping the Dublin Corporation "on the jog" until the water supply of the city is placed upon something like a proper footing. It is easy to blame the drought of the past summer; but blame should fall also on those who possessed the necessary means of counteracting the drought, and who allowed things to drift, instead of facing the situation in a prompt and practical manner. The Committee, however, are gradually waking up, and at length realize that the contingency of a still longer and more serious drought has to be provided against; and, no doubt, they are now genuinely desirous of doing all that is possible to avert further complications.

Their hands indeed, are more than full at present. Arrangements are in progress with the Midland Railway Company for providing a supply of water from the eighth lock or other level of the Royal Canal—a supply which it is proposed to carry along the canal bank in order that it may be emptied into the city mains. For this purpose an expenditure of from £4500 to £6500 will be required. Then negotiations are proceeding with the Rathmines Commissioners for the purchase of their disused works at Gallonstown (on the eighth lock level of the Grand Canal). These works, which originally cost between £11,000 and £12,000, are to be had for about one-third of the money; and the Corporation will be incurring a serious responsibility if they allow them to slip through their fingers. According to Alderman Dillon's statement, however, at the first of the two special meetings, the Committee are only seeking power to acquire the works "if they "should be required." It seems, that, not content with approaching the Railway Company and the owners of the Gallonstown works, the Committee are also treating with certain local brewers and distillers who have intimated their willingness to purchase the property and hand it over to the city, if the Corporation will lay pipes from the city boundary to the breweries and distilleries, so as to give them an additional supply. The brewers and distillers of Dublin represent a great commercial interest. They are men of business, and know just what will answer their purpose. But it is by no means equally certain that the Water Committee are correspondingly alert, and capable of understanding the duty which they owe to the inhabitants of the city and of the out-townships, comprising altogether a population of 340,000. Of course, the precise advantages of the alternative course may only be appreciable by those who are on the spot. But, speaking generally, we should regard it as highly inexpedient that the Corporation of Dublin should accept any so-called favours from the brewers and distillers. They may count upon them for custom; but there would seem to be no occasion for regarding them in the character of benefactors. The Corporation have the control of the water supply. Let them show that they know how to fulfil their trust.

It is to be observed that there was a marked difference between the tone adopted by Alderman Dillon at the first and second special meetings respectively. There was ample reason for his change of front. Instead of complaining of criticism, the worthy Alderman, in his second speech, informs the Council that they are "face to face "with a position that requires to be grappled with in the "most energetic manner." He admits the force of what we have said, by confessing that the temporary arrangements which the Water Committee are making will only tide the Council over the year. Finally, and in plain language, Alderman Dillon declares that it would be criminal in the extreme to allow another year to pass without taking adequate steps to supplement the water supply! More than this could hardly be expected by way of open confession and candid warning. We welcome the Alderman's conversion to a full consciousness of the disgraceful condition of the water supply at the present time, and gladly note his recognition of the folly of relying on mere hand-to-mouth remedies.

But, unfortunately, something amiss in the municipal machinery of the Irish capital—wilful blindness, or contemptible jealousy—still clogs the wheels of progress. The Council are afraid to entrust the Committee with too much power. The Lord Mayor himself throws cold water on the newly-developed energy of Alderman Dillon

and his colleagues; and other members of the municipal body follow suit. They are not yet convinced, it seems, of the urgency of the situation and of the need for heavy expenditure. At present, the position is that the Council have refused to give the Committee a free hand and a wide discretion. They have, however, sanctioned the taking of the preliminary steps towards obtaining a Provisional Order or an Act of Parliament. This is well enough, as far as it goes. But the manifest inclination to higgle and delay cannot longer be ignored. The people of Dublin may be inclined to feel thankful for small mercies; but in this matter of the water supply we strongly counsel them to keep their municipal rulers up to the mark, and regard the recent awakening merely as a first step toward the needed measures of broad and drastic reform.

Death of Mr. Bailey Denton.—We regret to announce the death, on the 19th inst., at Stevenage, in his 79th year, of Mr. John Bailey Denton, M.Inst.C.E., whose name is so well known in connection with the advancement of agriculture. Something like half a century ago, Mr. Bailey Denton was associated with the late Mr. Brassey and Mr. Locke, M.P., in railway construction; but he came more prominently before the world as an agricultural reformer. For the last forty years of his life, he devoted his attention entirely to questions of the storeage of water, water supply, and sewerage; and he was the prime-mover in the introduction of the system of applying towns' sewage to land, instead of discharging it into the nearest rivers or streams. He was senior partner in the firm which still bears his name in Westminster. Deceased was for more than fifty years a member of the Institution of Civil Engineers, connected with the Surveyors' Institution from the commencement, and associated with several of the learned societies of England and the Continent. He was also for more than a quarter of a century a Magistrate for Hertfordshire.

Death of Mr. S. H. Louttit.—It is with much regret that we record the death, on the 18th inst., at his residence in Clapham Park, of Mr. Samuel Henry Louttit, the Secretary and General Manager of the Lambeth Water Company. Mr. Louttit was born in Falmouth in 1838; and, as a young man, he distinguished himself in engineering works of some magnitude. About seventeen years ago, he accepted the appointment which associated him with the great work of the supply of water to the Metropolis; and this position he filled till his death. The services he rendered, not only to his own Company, but to the whole of the Water Companies of London, are well known to all who have studied their history during the past fifteen years. He was actively engaged in connection with the important investigation made by the late Mr. E. J. Smith into the financial position of the Companies at the time of Sir W. Harcourt's Committee in 1880; and he watched with keen interest all the subsequent legislation affecting their undertakings. The proceedings of the recent Royal Commission were necessarily closely followed by Mr. Louttit; and doubtless the strain put upon him during that protracted inquiry told upon his health, which, of late, had not been very good. He had complete grasp of details; and displayed sound judgment and broad principles. His removal, at the early age of 55, will cause a vacancy in his department of water-works administration which it will not be easy to fill.

Gas Lighting for Public Conveyances.—A few weeks ago we quoted from the *Lancet* some remarks on the inadequate lighting of public conveyances. We learn that an improvement in this respect is now being effected by the South London Tramways Company and the London Road Car Company, by the introduction of gas lighting in their cars. The illuminant selected is the oxy-oil gas of the Hydro-Oxy Gas Patents Proprietary, Limited. A preliminary trial of this gas for car lighting was made on the line of the first-named Company on the 13th inst., by permission of the Manager (Mr. C. H. Miller); and the results were highly satisfactory. A second run was made on the evening of the 18th inst. (not, it must be admitted, a favourable one for the experiment, as the weather was very boisterous), when the previous results were fully confirmed. The gas is stored in two cylinders at a pressure of 150 lbs. per square inch, and is supplied therefrom to two "No. 0" Bray burners placed in the positions usually occupied by the oil-lamps. With a consumption of 1½ cubic feet of gas per hour each, the car was brilliantly illuminated in all parts. It is stated that sufficient gas for ten hours' supply can be carried without adding much to the weight of the car; while, in the important matter of cost, we are informed that the gas comes to about one-third more than oil. But there is, of course, to be set off against this extra expense the superiority of the former illuminant, which has from eight to ten times the lighting power of the latter. Last Wednesday, one of the large omnibuses of the London Road Car Company was lighted with oxy-oil gas for a trial trip through the principal West-end thoroughfares—a single burner being used. The light was tested by all kinds of print—even by a "Bradshaw;" and its excellence was proved beyond question. We understand that it is in contemplation to adopt the new system of lighting generally on all the tramway lines.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1004.)

THE improvement in the general position of things on the Stock Exchange, which was beginning to show itself a week ago, has not made much progress during the week just closed. Indeed, at the opening, there was rather a disposition towards reaction, and prices eased down a little; but later on the more favourable turn was restored. But at no time was there anything in the least approaching a sign of resumption of activity; and the prevailing tendency was to avoid any commitment ahead, and to snatch a profit, however small, wherever it could be made. Nervousness and apprehension exercised a powerful influence; and nothing was wanted but choice investment securities. The demand for these is so much in excess of the supply, that inevitably resort must be had to the next best in the order of selection, with the result that the prices will rise proportionately. Just at present the Money Market is a little stiffer, a demand having sprung up, especially for short loans; but there is nothing yet apparent to indicate the approach of any important or decisive movement. Business in the Gas Market has been considerably more active, particularly in the larger issues, Gaslight and Coke, South Metropolitan, and Imperial Continental; and the quotations show a substantial advance. Gaslight "A" commenced to improve at once from the opening; and, after a good many transactions had been marked at pretty steady figures, it reached 230½ on Saturday—an effective advance of 2 in the quotation. Dealings in the secured issues were much quieter; but what few were touched changed hands at good prices. South Metropolitans showed a tendency to improve, though quotations did not alter; and the debenture stock was several times done at the nice figure of 151. Commercials were almost stagnant; there being next to no dealing in them. The Suburban and Provincial Companies also were excessively quiet—two or three transactions in Brighton and Hove being almost all that was done. At the Mart, however, on Wednesday, that Company disposed of an issue of £20,000 ordinary 7 per cent. stock by auction—the prices realized for the whole averaging about 141½. Among the Continental undertakings, Imperial began to recover from its recent depression, and finished an active week with an advance of 3. Continental and European were unchanged; but Malta receded fractionally. No conspicuous incident marked any of the rest; but the price of Oriental was lowered ¼ in view of the resolution to reduce the dividend this year. A fair amount of business was done in Water Companies' stocks; the changes in quotation being slight, but irregular.

The daily operations were: The Gas Market was rather quiet on the opening day; but prices generally of the chief issues indicated a favourable tendency. Gaslight "A" rose 1. Oriental, however, fell ¼; and Grand Junction Water receded 1. Tuesday's business was largely in that issue; and again an advance of 1 was scored. Wednesday was a very active day, with frequent dealings in Gaslight "A," South Metropolitans, and Imperial Continentals. All commanded good prices; and Imperial rose 1½. On Thursday, Gaslight "A" was again conspicuously active; but the price was not any better. East London Water fell 2. Friday was somewhat quieter; but the prices of everything dealt in remained firm. West Middlesex Water rose 2. Saturday's business was limited, as usual; but some of the best prices of the week were realized, and Imperial Continental made a further advance of 1½. Malta fell ¼.

ELECTRIC LIGHTING MEMORANDA.

The Dinner of the Institution of Electrical Engineers—The Utilization of the Power of Niagara—The Examinations of the City and Guilds of London Institute.

THE Institution of Electrical Engineers held their fifth annual dinner last Wednesday, when Mr. W. H. Preece presided, supported by the President of the Board of Trade, the Postmaster-General, and a goodly number of scientific and engineering celebrities. The function was a pleasing illustration of the dependence of the newest applied science upon old-fashioned ways of encouragement; for even electricians must eat, and are no farther above the enjoyment of mutual admiration than other orders of humanity. It is so easy to say pretty and promising things about electrical engineering, that the after-dinner speeches of the guests of the Institution upon this occasion ought to have been interesting and entertaining in a high degree; and it is pleasant to be able to testify to the fact that the speakers one and all realized a high percentage of "duty" in this regard. The palm for gracefulness of expression must be awarded to Sir J. Crichton Browne, who said of electrical engineers that "they had vastly increased the comforts and convenience of modern life; they had added enormously to the means of human intercourse; they had afforded invaluable assistance to the students and investigators in every department of science." On the other hand, the depth of false antithesis was sounded by the President, who repeated his fantastic claim for the electric light as being the poor man's light, with the added piece of nonsense that the trouble of it is not that it is too dear, but that it is "too cheap." This

exercise in the "new humour" may be all very well once in a way; but Mr. Preece is so prolix a speaker, that he has to make his jokes serve more than once, with the result that a strain after effect, which might be feebly amusing when fresh, becomes irritating in the repetition. Of course, the incandescent electric light must be too cheap, if Mr. Preece says so; the same might be said of diamonds, old champagne, unlimited loo, and other necessaries and ameliorations of the poor man's lot. Let this be understood and admitted in compliment to him; then, perhaps, when next Mr. Preece orates upon his favourite subject, he will say something new about it.

Professor Forbes has communicated to the Institution of Electrical Engineers a description of the means adopted for utilizing and distributing, through the agency of electricity, some of the energy developed by the Niagara Falls. The magnificent inutility of this grand natural phenomenon has been a source of regret to many minds ever since it was first seen and described by civilized man; and the Cataract Construction Company, who have the water rights, may therefore be congratulated upon what they are doing to remove some of this reproach from the Falls. Unfortunately, the greater part of the force of the Falls will still be wasted. Enough, however, has been taken in hand to constitute a power plant of considerable magnitude in comparison with other arrangements of the kind; and this is sufficient reason for the scheme being watched with interest by engineers and electricians. Perhaps the most instructive aspect of Professor Forbes's paper is the information it supplies reflecting the present condition of practical electrical engineering in relation to power distribution. We notice that his solution of the problem presented to him as adviser of the Construction Company does not command the unreserved admiration of electricians. This is no more than might have been expected; for the unanimity with which electrical experts "agree to differ" is amazing. Meanwhile, whether the Company succeed or fail in their enterprise, we must remember that it is a "far cry" to Niagara; and it would be much more interesting if electricians would make greater progress in the application of electrical power to locomotion and other purposes at home.

The subject of the examinations in Electrical Engineering by the City and Guilds of London Institute is attracting the attention of those who are interested in the spread of electrical instruction; and some critical remarks on the Ordinary Grade examination have been made in the *Electrical Review*, which go very much on the lines of the observations recently addressed by us to the Administration of the Institute respecting their failure to reach the journeyman. The electrician critic complains that the Institute does not touch the case of "wiremen and electric light fitters, and our local electricians, who are often in business as ironmongers, carpenters, plumbers, and gas-fitters." These men do not wish to qualify as "electrical engineers;" but it is admitted that they would make first-class wiremen, if properly taught. The case of the journeyman electric light fitter is exactly the same as that of the journeyman gas-fitter, who is commonly a more or less inefficient "three branch hand." The popularity both of electric and of gas lighting largely depends upon the way in which the needs of the user and consumer are understood and met by the workman with whom he comes into most intimate contact. It is good that gas manufacture and electrical engineering should be systematically taught; and the periodical publication in the columns of the journals devoted to different industries of the question-papers and pass-lists in connection with the Institute examinations, is a valuable agency in this regard. As we have already argued, however, and as electricians are now beginning to plead, the great industries of lighting give employment to many thousands of intelligent mechanics, all of whom have to pick up their trade as they practise it, and most of whom would certainly be better for a little instruction in its principles. The electric lighting industry, as such, is as powerless to move in this matter as the gas industry; for in the case of neither does the manufacturer control the fitter, who is independent of the "undertaker." This severance of the domestic from the manufacturing branches of the great lighting industries may be defended upon some grounds; but it is productive of no little mischief and much loss.

North British Association of Gas Managers.—We have received a copy of the report, in pamphlet form, of the proceedings of this Association on the occasion of the 32nd annual meeting, held in Dundee in July last, under the presidency of Mr. T. Douglas Hall, with the rules, list of members, &c. Bound up with it is the "Statistical Report of the Gas Supply of Scotland" for the year from July 31, 1892, to Aug. 1 last, by the Committee of the Association.

The Chaloner Testimonial.—In the JOURNAL for the 24th ult., we announced that a project was on foot to present a testimonial to Mr. G. Chaloner, F.C.S., as a mark of the good-will and esteem of his friends and old students in the chemistry classes at the Birkbeck Institution, the direction of which he has resigned. We are now asked to state that the testimonial will take the form of an illuminated address and a purse of money; and that the presentation will be made in the small hall at the above-named Institution, Bream's Buildings, E.C., on the 11th prox., at 8.30 p.m.

THE LABOUR QUESTION IN BELGIUM AND GERMANY.

THE volumes of Foreign Reports issued by the Secretary of the Royal Commission on Labour (Mr. Geoffrey Drage) are among the most valuable first fruits of this great investigation, inasmuch as they throw a much-needed light upon the international aspect of industrial relations. The fourth of these volumes relates to Belgium. It is the outcome of many communications to the Commission from the Foreign Office, supplemented by information gathered by Mr. Drage in the course of a visit to Brussels in 1892, and by correspondence since received. The portion of the report on the labour question in Belgium which specially interests us is that which deals with the rise of the present relations between employers and employed, and the development of Socialism. These matters led to the appointment of a Labour Commission there in 1886, which resulted in the issue of a report in two volumes, and the consequent passing of a considerable number of laws. It is remarked that the relations between employers and workmen in Belgium vary greatly in the different industries throughout the country, and in individual establishments; but, as a rule, they leave much to be desired. Several causes of this unsettled feeling are mentioned, of which the principal is perhaps the introduction of the factory system and the change from small to large industries, by which the former close intercourse between masters and men has been rendered impossible. Socialism is stated to be a direct consequence of this estrangement between capital and labour. All those who are interested in the history of the rise and progress of the "International," and other Belgian embodiments of socialistic principles, would do well to procure a copy of this volume. The admixture of politics with Belgian labour questions gives a peculiar character to the latter. Among other results of this blending of political and industrial considerations must be classed the establishment by law of "Councils of Prud'hommes" for dealing with wages disputes and conciliating or arbitrating between employers and employed. The constitution and operation of these institutions are fully described by Mr. Drage. Besides these there are superior Councils of Conciliation and Arbitration both for particular districts and for particular industries. The detailed information given in the report of the condition of the Belgian coal industry will be read with interest at the present time. It is stated that at two collieries—Mariemont and Bascoup—a system of profit-sharing has been introduced with satisfactory results. This movement has not, however, made much headway in Belgium. The question of employers' liability appears to be in an unsettled state.

In the fifth volume of the series, which relates to Germany, Mr. Drage puts out vastly greater strength than in the preceding one, which is mostly compiled from second-hand materials. This study of labour conditions in Germany has evidently been a work according to his own heart; and he admits that it is largely the fruit of years of travel and study undertaken before the creation of the Royal Commission. It is, to all intents and purposes, a treatise on the development and condition of German industrial life; and its importance at the present time does not need to be shown by argument in face of the irruption of German-made goods—and social principles—into all parts of the world.

Germany, as Mr. Drage is careful to point out in the commencement of his report, is a new Empire composed of many old nations. Consequently, it is a field wherein all sorts of industrial, administrative, and social developments may be seen in operation together. Many of the laws of the Empire are new and experimental, and much of the condition of the people subject to these laws is the result of influences and circumstances of hoary antiquity. The freest thought and the most hide-bound practice have gone together to make the Germans of to-day the most theoretical and the hardest of Continental peoples. The proudest aristocracy and supreme militarism coexist there with the rankest democracy and the most absorbing commercialism. In Germany, Socialism had its rise. Our English and American Socialists have drawn all their principles ready made from men like Marx or Lassalle; and the Imperial scheme of workmen's insurance is the boldest experiment which a really despotic Government ever attempted in the desire to deal with the evil of senile pauperism.

When reading the modern propaganda of Socialism, advanced as a panacea for industrial ills, and recognizing in it the mainspring of the "New" Trade Unionism, most people must have been conscious of knowing little more of Marx and Lassalle, the acknowledged founders of the Socialist movement, beyond their names. Not many of those who utter these names with all the glibness of the confirmed disciple have read the works in which these leaders have enshrined their doctrines; and the task, by all accounts, is of a nature to daunt the boldest. All that it is necessary or desirable to know about Marx and Lassalle may now be gathered from a page of Mr. Drage's report. The same careful hands pilot us through the mazes of Bebel and Liebknecht's Social Democracy, and make us acquainted with the characters of the successive programmes of the German Socialist Party, and the pronouncements of the latter Anarchists. Mr. Drage's comments upon all these matters are of profound interest. His conclusion respecting the German Socialist movement is that "it appears probable that the organization of

labour will proceed upon socialist, and at the same time non-revolutionary lines; but that the growing power of Socialism amongst the German working men will of necessity put an end to the present disintegration of religious and political parties."

THE CENSUS OF PERSONS ENGAGED IN GAS-WORKS.

In the JOURNAL for the 7th inst. (p. 843), we published some statistics, extracted from the last Census Returns, in regard to the number of persons employed in connection with gas-works in England and Wales. We now supplement these particulars by giving the figures relating to Ireland and Scotland.

The total number of persons engaged in gas-works in Ireland in 1891 amounted to 1307. Of these, 1050 are reported as able to read and write; 93 as able to read only; and 164 as unable to do either. The Irish volume does not furnish such detailed statistics as are given in the English one; but it contains rather elaborate particulars as to the religious beliefs of the Irish population. With regard to the gas-works service, it may be of interest to record that 845 persons profess the Roman Catholic religion, 228 are Protestants, 158 are Presbyterian, 52 are Methodists, and 24 are of various other persuasions. Of the 12,900 foreigners of European birth resident in the island, only one is engaged in gas-works service.

Turning to the volume issued from the Scottish Census Office, we find that there were 3616 persons engaged in connection with gas-works. Only two foreigners, out of a total of 7360 in the country, appear under the foregoing heading. In this volume there is a table showing the number of persons resident in 37 various burghs of Scotland who were employed in gas-works in 1891. The places are given in alphabetical order; but, as a convenient means of reference, we arrange them here in accordance with their numerical strength:—

Glasgow	1402	Hamilton	14
Edinburgh	361	Pollockshaws	14
Aberdeen	135	Stirling	13
Dundee	130	Inverness	13
Leith	129	Falkirk	13
Greenock	85	Dunfermline	13
Paisley	75	Airdrie	13
Partick	40	Rutherglen	12
Perth	38	Galashiels	11
Kilmarnock	31	Alloa	11
Kirkcaldy	25	Dumbarton	10
Kinningpark	24	Peterhead	10
Coatbridge	24	Hawick	9
Motherwell	24	Forfar	9
Govan	17	Montrose	9
Dumfries	16	Clydebank	7
Port Glasgow	15	Dysart	6
Arbroath	15	Wishaw	4
Ayr	15		

THAMES CONSERVANCY LEGISLATION.

It will be useful, in view of the introduction of the Bill for the re-constitution of the Thames Conservancy Board, to glance at past Conservancy legislation and the present position of the Conservators in relation to the London Water Companies. Mr. Bassett Hopkins, Chairman of the Water Committee of the London County Council, has already foreshadowed serious conflict in reference to the passage of the new Bill; and he is evidently afraid that terms will be made between the Conservancy Board on the one hand and the Water Companies on the other, which may strengthen the position of the latter, and at the same time lessen the opportunity for attack which the London County Council are always so eager to discover. Hitherto the Thames Conservancy Board have had nothing to thank the County Council for; while their financial alliance with the Water Companies has undoubtedly been the means of enabling the Conservators to carry out their numerous duties, not, it is true, with complete success, but still in a measure which would have been impossible but for the aid of the Companies. The introduction of divided counsels and conflicting interests in the administration of the Conservancy is scarcely likely to be productive of good results to the community at large. Indeed, the comparative failure of the Conservators hitherto to fulfil their statutory mission renders it a matter of serious doubt whether they will be able to do in the future even as well as they have done in the past, if they are to be handicapped by the manœuvres of the London County Council.

Until the year 1857, the Corporation of London acted as Conservators of the Thames; and they troubled themselves very little about it. Some years prior to that date, however, a dispute arose as to jurisdiction over the river banks; resulting in a heavy Chancery suit between the Conservators and the Crown. These proceedings lasted for ten or twelve years; and the unsatisfactory state of things thus made manifest led to the passing of the Conservancy Act of 1857—a statute which has a preamble of prodigious length and complex character. Of course, it became necessary from time to time to supplement the original Act by various amending measures. There was an Act in 1864; and a third Act, of a more important character, in 1866. It was by virtue of the last-mentioned statute that the Conservators acquired the control of the Thames and Isis from Staines to Cricklade; and it was thereby expressly enacted that it should not be lawful for any person to open into the river any sewer, drain, pipe, or channel, or attempt to provide for the flow or passage of sewage or any other injurious matter. Heavy penalties were provided for any infringement of the Act; and the right of prosecution was vested in the Conservators alone.

There was, however, yet more legislation in store; and accordingly we find Conservancy Acts passed in 1867, 1870, and 1878. The Act of 1878 conferred a considerably extended jurisdiction; it being provided that the Conservators might exercise their powers not only along the river itself, but for ten miles on either side of the stream. In this Act, too, recognition was given to the arrangement which had already been made between the Conservancy Board and the Chelsea, Lambeth, Grand Junction, Southwark, East London, and West Middlesex Water Companies. These Companies had for some time previously made annual payments to the Conservancy Board for the right to draw specified quantities of water from the river. This, of course, was an advantage to the Companies of which the importance cannot be exaggerated; and, *per contra*, without the contributions made from the coffers of the Companies, the Conservators would have been powerless to carry out their duties. In fact, it was to enable the latter to secure the protection of the upper reaches—*i.e.*, the waters between Staines and Cricklade—that the Companies agreed to increase their annual payments to an aggregate amount of £18,000 a year, or more. It is matter of history that, notwithstanding all this legislation, the Conservators were for many year defied by the Local Board of Staines. Enormous sums were spent in litigation; and it was only three or four years ago that a Divisional Court, consisting of Justices Field and Wills, gave the victory to Staines, by holding that occupiers of houses in that town had acquired a prescriptive right to let the drainage of their premises flow into the river.

Of the legislation of the present year, which has already been noticed in the JOURNAL, it would be unnecessary to speak further. But this review of the earlier statutes, and of the arrangements between the Conservators and the Water Companies, sufficiently indicates the complicated character of the situation, and the opportunities for mischief which will be afforded if at any time the London County Council should succeed in obtaining a dominant voice in the direction of the Conservancy Board.

NOTES.

The Construction of Steel Main Pipes.

An important practical point in connection with the general use of steel for making boilers, large pipes, &c., subjected to high pressure, was brought out in an investigation undertaken by Mr. Lavington E. Fletcher upon the cause of failure of a steel water-main, and detailed in his report to the Committee of Management of the Manchester Steam Users' Association. The structure in question was composed of a number of pipes 26 inches in diameter and 10 feet long, made of open-hearth steel 7-16th inch thick in one piece, so that there was only one longitudinal butt-joint, which was covered by a strap of the same thickness. Although calculated to have a bursting pressure of 1200 lbs. per square inch, several of the pipes gave way at a pressure of 70 lbs. or less—opening at the seam. The steel at these parts was found to be as brittle as earthenware, although when annealed it became perfectly tough and ductile. The result of the inquiry into the whole circumstances was to show that the body of the pipes was made of Siemens-Martin plate; but the butt-straps were made of flat steel rolled bars 4½ inches wide, delivered to the makers of the pipes cut to lengths and correct to width. As the butt straps were longitudinal, the strain tending to split the pipes open was across the grain. To guard against this in the case of boilers, the Association have a standing rule that butt straps for boilers shall not be sent to the boiler makers already cut to size, but must be supplied in a plate, to be properly cut up by the boiler maker, and in such a way that the grain in the butt strap shall run circumferentially. It was also found that the rivet-holes were punched, instead of being drilled; and that the butt straps were annealed by heating piecemeal over a smith's fire, instead of uniformly in a furnace. The accident was very instructive, as showing the necessity, before using steel in the construction of steam-pipes or boilers, of making a searching test of the plates.

A High-Temperature Thermometer.

It is often desirable, in industrial working, to have a means of readily determining temperatures above the range of the mercury thermometer, without employing the paraphernalia of an electrical pyrometer. The Baly and Chorley thermometer is recommended in a contemporary as a convenient appliance for this purpose. These thermometers are in size and appearance almost exactly similar to an ordinary mercurial thermometer, from which they differ in being filled with a sodium and potassium alloy which will bear an extremely high temperature without alteration. They are also made of a special glass, which does not soften under a temperature of 650° C (about 1200° Fahr.), so that they can be employed for any heat up

to perceptible redness. They are reported to be carefully graduated from 50° C., and can be relied upon to give concordant results for any period of time in careful hands, although, of course, at temperatures approaching their maximum range, they become very fragile, and must be gently used, and not subjected to violent alternations of heat or cold. As already mentioned, these thermometers almost exactly resemble the ordinary mercurial instrument; the only difference being the colour of the active material, which is red, owing to the action of the alloy on the glass.

The Economy of Artificial Fertilizers.

Those patrons of agriculture who are endeavouring to make the British farmer understand the profitable use of artificial manures, such as sulphate of ammonia, would do well to consult the works of M. Ville, as introduced to English readers by Professor W. Crookes, F.R.S. M. Ville's central position is that the keeping of stock for the purpose of manuring land is a capital error. Such manure, if carefully valued, is found to cost more than its actual worth, and much more than the price of an artificial manure of equal or superior value. Consequently, M. Ville argues that the keeping of live stock may be remunerative where their direct products, such as milk, meat, wool, &c., are marketable at fair prices; but to increase the value of arable land he would depend upon the employment of such artificial fertilizers as the nature of the soil might be found to need, together with the growing of nitrogenous crops for the purpose of being ploughed in. M. Ville places the sources of nitrogen in the following ascending series as regards their efficacy: Organic nitrogen, ammonium sulphate, sodium nitrate and potassium nitrate. He insists, above all things, on the maintenance of a due equilibrium among the constituents of plant food. M. Ville's conclusions agree in the main with those of the leading British agricultural chemists, except in respect of the use of lime, which he does not appear to recognize in any other form than gypsum, which is practically unknown in this country. His work is chiefly valuable for the light it throws on the economical aspect of so-called "natural," and artificial fertilizers—to the depreciation of the former.

The Light Intensity of Tints.

Mr. Joseph W. Lovibond has described in a work entitled "The Measurement of Light in Colour Sensations" the arrangement and applications of his "tintometer"—an exceedingly useful instrument for measuring and defining the exact tones and densities of colours. The pecularities of Mr. Lovibond's apparatus and system include the use of graduated coloured glasses as standards of comparison, of appliances for excluding sidelight, and for giving a direct view without the use of lenses, prisms, and reflectors. In addition, the author has a whole scheme of colour notation and nomenclature, whereby the faintest tints noticeable to normal vision may be named and classified. He poses as the three primary colours orange, green, and violet; and he limits the number of separate colour sensations to twelve, six of which are simple, and six compound. The practical applications of the tintometer are already numerous. It is extensively used in the examination of water, in the analysis of steel, and in paper making, flour milling, &c. Indeed, it is obviously indicated for use in any industrial process which involves the employment of the eye in judging colours. This has hitherto been dependent upon the interpretation, which may easily vary with different interpreters, of such terms as "dull red," "white hot," and so forth; and it must be of advantage to be able to assign a numerical equivalent to such vague expressions.

Four Different Lights from Molecular Vibration.

Mr. Nikola Tesla has demonstrated that the phenomenon of light is producible in four different ways by the action of high-frequency electricity upon suitable media. One of these methods is the incandescence of a solid, consisting of a small carbon button mounted upon a platinum wire in an exhausted bulb. When Mr. Tesla connected his body with one of the terminals of a high-tension transformer, and took an arrangement of this kind in his hand, the button became luminous. Next he took a highly exhausted bulb, containing a strongly phosphorescent body, above which was mounted a small plate of aluminium on a platinum wire leading to the outside; and the currents flowing through his body excited intense phosphorescence in the bulb. Thirdly he took in his hand a simple exhausted tube, and in the same manner the gas inside the tube was rendered highly incandescent or phosphorescent. Finally, he took in his hand a metallic wire, which appeared covered with a luminous film through the intensity of the electrical vibration. Mr. Tesla is now engaged upon the problem of producing these effects with less expenditure of energy than was employed in the operation as first arranged by him. Either method of converting molecular bombardment into light without heat, provided that it could be done economically, would be a considerable step forward in the direction where "the light of the future" is supposed to await its fortunate discoverer.

The Dividend of the Grand Junction Water Company.—At the forthcoming half-yearly meeting of the Grand Junction Water Company, the Directors will recommend a dividend at the rate of 8½ per cent. per annum on the ordinary share capital.

TECHNICAL RECORD.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The General Meeting of this Association was held last Thursday, at the Holborn Restaurant—the PRESIDENT (Mr. C. C. Carpenter, the Engineer of the Vauxhall works of the South Metropolitan Gas Company) in the chair. There was a large attendance of members; and several gentlemen specially interested in the subject of the paper to be brought before the meeting were also present.

The formal business on the *agenda* was first disposed of.

ELECTION OF OFFICE-BEARERS.

Mr. W. A. VALON (Ramsgate) proposed that the next President of the Association should be Mr. H. Smythe, of Maidstone. They had all known him for a number of years; and he was sure the selection of the Council was a wise one.

Mr. J. ELDRIDGE (Oxford) seconded the motion, which was unanimously carried.

Mr. SMYTHE briefly thanked the members for the honour conferred upon him—remarking that he did not know why they should elect him, excepting that he was an old member; but with their kind forbearance, and with the assistance of their able Secretary, he would do his best to maintain the position of the Association.

Mr. T. MAY (Richmond) moved the re-appointment of Mr. J. W. Helps to the Secretaryship; observing that the best thanks of the members were due to him for what he had done in the past, and they could not be in better hands.

Mr. SMYTHE seconded the motion, which was agreed to.

The HON. SECRETARY acknowledged this renewed proof of the confidence of the members; and said he would try, as he had tried in the past, to promote the interests of the Association.

Mr. J. C. WATSON (Lower Sydenham) proposed that Mr. J. Thorman, of West Ham, and Mr. W. A. Walker, of Worthing, be elected members of the Committee, in place of those retiring by rotation.

Mr. J. T. JOLLIFFE (Ipswich) seconded the proposition, which was passed.

On the motion of Mr. CHARLES GANDON (Lower Sydenham), seconded by Mr. T. PRICE (Hampton Wick), Mr. C. E. Botley and Mr. W. H. H. Broadberry were appointed Auditors.

NEW MEMBERS.

The PRESIDENT moved, Mr. R. P. THOMAS (Ware) seconded, and it was agreed, that the following gentlemen should be elected members of the Association: Mr. J. Cowney, of Seaford; Mr. W. B. Randall, of Waltham Cross; Mr. E. T. D. Sapey, of Horsham.

Dr. L. T. THORNE, Ph.D., F.I.C., then read the following paper:—

ON OXY-OIL GAS (TATHAM'S PROCESS), AND ITS USE FOR PURPOSES OF ENRICHMENT.

Rather more than two years ago, I laid before the Incorporated Gas Institute the results of some preliminary experiments which I had made to test the accuracy of the claims put forward by the patentee on behalf of the oxy-oil gas process; and, as a result of those experiments, I expressed my belief in its great value and future. At that time it was hoped that oxy-oil gas would very shortly be put to the practical test in a gas-works; but, from various causes—among which the disadvantage of the Syndicate owning the patents being located at the Antipodes, and the illness of the Syndicate's representative in England may be mentioned as the chief—its development has unfortunately been much delayed. Recently, however, very great progress has been made; and the introduction of the manufacture of oxy-oil gas on the practical scale at the Huddersfield Corporation Gas-Works for use for purposes of enrichment, has again directed the attention of the gas world to the process. I have lately been enabled to resume my study of the Tatham process, and to carry out a long series of tests at Huddersfield on its practical working there; and I beg to-day to lay before you the results I have obtained up to the present.

The essence of the Tatham process lies in the addition to heavy hydrocarbon gases (from whatever source produced) of considerable quantities of free oxygen—this addition being preferably effected soon after the gases leave the retorts, and while they are still hot. The method of producing these hydrocarbon gases is not an essential point in the process, and almost any of the existing forms of oil-gas plant, or plant for producing gas from rich shales, might be used in connection with it; and with many, very favourable results would be obtained. It is found, however, that the heavier the hydrocarbon gases are, the greater is the benefit effected by the addition of the oxygen; and, as will be known to you all, the lower the temperature at which the oils are *cracked*, and the less heated retort-surface the vapours and gases have to traverse after cracking, the heavier is the gas produced. The less permanent character of the heavy gases thus ordinarily produced is more than neutralized by the increased stability given to them by the

peculiar carrying power of the oxygen which is added; and the use of comparatively low temperatures for cracking obviates to a very large extent the difficulties of soot and pitch production which have militated so much against oil-gas making as hitherto usually attempted.

When to a heavy oil gas, which shows signs of smoking even when burning from a No. 0 Bray burner, oxygen is admitted while the oil gas is still hot, the illuminating power of the gas is raised. The maximum increase is obtained when from 12 to 18 per cent. of oxygen (according to the character of the oil gas) has been added. Further addition of oxygen, up to about 16 to 24 per cent., causes no further change in the actual illuminating power, though it renders the flame stiffer, whiter, and brighter to the eye, reduces the size of the dark zone, and improves the general shape and appearance of the flame. Further addition of oxygen gradually reduces the illuminating power of the gas. With low quality (or lighter) oil gas, the percentage of oxygen which may be profitably added is considerably smaller. The increase of illuminating power with very heavy oil gas is 25 per cent., or even more; with lighter oil gas, rather less than this. The actual percentage of oxygen which is added in practice depends on the one hand on the quality of the oil gas made, and on the other on the use to which the oxy-oil gas is to be put. If it is to be used for the enrichment of coal or other gas, about the percentage of oxygen requisite to get the maximum increase in the illuminating power of the oil gas is added. If the oil gas is to be used for burning *per se*, a rather larger percentage of oxygen is employed. When dealing with petroleum or shale oils (which have as yet been mainly used), the percentage of oxygen in the oxy-oil gas may be broadly stated as 15 per cent. when made for enrichment purposes, and 20 per cent. when made for burning *per se*.

The actual illuminating power of oxy-oil gas depends, of course, on the oil or other material from which it is made, on the temperature at which that oil is cracked, and on whether the oil is only once run through the retorts, or whether the residuals are further used up by repeated re-cracking. To give a couple of instances of actual experiments: A high-class Scotch shale oil (Oakbank oil), such as is used by some of the railway oil-gas works, yielded, "once run," 74 feet per gallon of oxy-oil gas, showing an illuminating power of 98 candles. From this, there was about 40 per cent. of residuals. On further completely cracking these residuals, 44 feet more of oxy-oil gas per gallon of original oil were obtained of an illuminating power of 71·2 candles. The total gas produced was thus 118 cubic feet of 88-candle gas per gallon of oil used, or about 30,000 cubic feet of 88-candle gas per ton of oil. From a sample of Russian Solar Distillate of ·887 specific gravity, the yield was 103 cubic feet of 85-candle gas per gallon of oil, or 25,500 cubic feet of oxy-oil gas per ton.

These results can hardly be expected to be reached in practical working; and my idea is that the most economical working in practice will be to produce an oxy-oil gas of about 80-candle power, of which at least 25,000 cubic feet per ton would be obtainable from oil such as Russian Solar Distillate. Experiments point to the cheaper kinds of Russian and American oils (which are, however, at present not obtainable on the English market) giving even better results than the oils already mentioned. Furnace oils, and many other residual oils, may also undoubtedly often be profitably used in this process; but enough work has not yet been done on this branch of the subject to enable me to give actual and reliable figures.

In speaking of the candle power of this gas, it should be noted that all the readings are given from actual photometric tests taken on a 100-inch open bar photometer against a two-candle Methven screen—the oxy-oil gas being burned at a slow rate from an ordinary small Bray union-jet (Nos. 0 to 2), and the results obtained calculated to 5 cubic feet consumption. If compared (say) with 16-candle coal gas burning through a No. 5 or No. 6 Bray burner, the oxy-oil gas of 98-candle power would appear of at least eight or nine times the illuminating value of the 16-candle gas. In other words, while the average ordinary consumer, using flat-flame burners, really only obtains from 70 to 80 per cent. of the nominal illuminating power of ordinary 16 to 20 candle gas, he would with oxy-oil gas obtain the full nominal value.

In estimating the relative values of oil and oxy-oil gas, another important point must be taken into consideration. Careful experiments have shown that when, in the making of the gas, the residuals are worked up, not only is the illuminating power of the oxy-oil gas greater than that of the oil gas *alone*, but that the yield of oil gas (apart from added oxygen) from the oil is, under like conditions of working, from 10 to 15 per cent. larger when oxy-oil gas is being produced than when simple oil gas is made. The cause of this result is not easily explicable; but it probably lies in the retaining in the gaseous form, by the oxygen, of some of the hydrocarbons which would otherwise be condensed as residuals, and the consequent reduction of the amount of re-cracking of residuals required. Running parallel with this increase of volume there appears to be a smaller quantity of coke produced during the manufacture of oxy-oil gas than during that of plain oil gas.

The cost of this gas must, of course, largely depend on the price of the oil used. Russian Solar Distillate and Scotch "green" shale oil can now be obtained in bulk in England at about £3 per ton; and there is no doubt that, when a large demand for low-quality oils arises, arrangements will very soon be made for bringing such oils into the country, and oil as suitable, if not more so, for the purpose will be obtainable at a far lower figure—probably £2 10s. per ton, if not even much less. In view of the present large Russian, American, and other oil-fields in operation, and the further known ones which have not yet been tapped for want of a market, the fear that the price will go up is absolutely unfounded. Based on the present price of oil, the cost of an 80-candle oxy-oil gas should not certainly exceed 3s. to 3s. 6d. per 1000 cubic feet into the holder. As the gas stands compression with much less loss of light than ordinary oil gas does, this should give oxy-oil gas a most favourable field in the lighting of railway carriages, &c. In fact, trials have already been successfully made in the lighting of tramcars and omnibuses.

In America, with suitable oil obtainable at about 20s. per ton, oxy-oil gas of 80-candle power should be manufactured at about 2s. per 1000 cubic feet; and there it should become—either *per se* or reduced to (say) 40-candle power—a formidable rival to the present coal gas and carburetted water gas on the one hand, and to the electric light on the other, as the light produced is very diffusive, white, and pleasing. It may also be very advantageously used in America for enriching water gas. Another good field for this gas in America should be the enrichment of the natural gas (marsh gas) which is at present used for fuel. Some experiments which Professor E. Frankland and I carried out in 1877 (see *Journal of the Chemical Society*, Vol. XXXIII., 1878, p. 93) show that this gas when enriched with benzene, gives about 30 per cent. better results than either hydrogen, carbonic oxide, or water gas gives. One cubic foot of benzene vapour, when mixed with these gases, gave respectively: With hydrogen, 69·7 hour-candles; with carbonic oxide, 73·4 hour-candles; and with marsh gas, 93·2 hour-candles—the effect with water gas lying, of course, between those with hydrogen and carbonic oxide. Similar results would undoubtedly be found with oxy-oil gas. Many processes have already been tried for the production from this natural gas of illuminating gas; but have all proved failures, mainly from the want of carrying power of the enricher employed. By the addition of oxy-oil gas to the natural gas, a thoroughly permanent gas of high candle power could be easily and economically obtained.

In England, the largest field for oxy-oil gas in the immediate future lies undoubtedly in its use for enriching coal gas. It is on this ground that the present installation at Huddersfield is particularly interesting to gas engineers, and that a short account of the installation, and of the results obtained therewith up to the present, may be acceptable to the members of this Association.

The plant at Huddersfield is designed to produce 200,000 cubic feet of oxy-oil gas per 24 hours; the intention being eventually to add 5 per cent. of oxy-oil gas to the whole of the gas supplied to the town, and thus give a very high-class gas of about 20-candle power. The oxygen plant, put up by Brin's Oxygen Company, has been working for some time. It is built in two independent sections, is capable of producing 30,000 cubic feet of oxygen per day, and is the largest oxygen producer ever yet erected. The oil plant will, when completed, consist of four or five bays, each bay containing 15 retorts. At present only one bay is in actual work, as it was thought advisable, in a new departure such as this, to carefully try the system of retorts adopted in one bay before proceeding to the erection of the remainder. Slight improvements have been made in the mode of setting of the retorts and of their fittings, which will overcome some slight difficulties which have been experienced; and the completion of the remaining bays is now actively in progress. In each bay there are 15 cast-iron retorts, arranged in rows; the three upper rows being of four each, the bottom row of three. The retorts are 7 feet long; the twelve upper ones being 8 inches in diameter, and the three lower ones, intended for cracking the heavier residuals, 10 inches in diameter. The retorts, which are double-ended, are set at a slight fall (about an inch) towards the back; and they have some 5½ feet of heated surface between the furnace walls. The back covers, used for cleaning out, are fastened by clamps.

The oil is fed into the retorts by means of 2-inch feed-pipes, passing through the front retort-covers, and terminating about two-thirds of the way down the retorts. They are fastened to the front retort-covers by clamp flanges, so as to be easily removed for cleaning and duplicates are kept to replace them when so removed. The oil is supplied to these feeds by means of specially constructed syphons fitted with floats. These floats are so arranged that any stoppage in the feed-pipe, or excess of pressure in the retort, at once raises the float; and this, in rising, automatically closes the oil supply to that particular retort. The fittings and pipes are also arranged so that any one row of retorts may be shut off for cleaning. In the bay at present in operation, the three upper rows of retorts are fed with clean oil; the lower, and hottest, row with residuals. It has been found, however, that this is not enough retort power for the cracking of the residuals; and, in the bays in course of erection, provision is made by which the next row of retorts may, at will, be fed with light residuals or with clean oil. The cracking temperature used is a dull red heat; the flow of oil being regulated to produce a canary-coloured gas. The best results are obtained by keeping a fairly large stream of oil flowing into the upper retorts, and re-cracking the considerable

proportion of residual then obtained. The oxygen is admitted to the oil gas soon after the latter leaves the retorts, and while still hot. The admission of the oxygen is proportioned by a specially constructed meter, coupled to and consequently controlled by, the oxy-oil gas station meter. This meter is so coupled that, for every 100 feet of oxy-oil gas passing the station meter, 15 cubic feet of oxygen are admitted through the oxygen meter to the warm oil gas. Arrangements have been made by which the oxy-oil gas may, at the will of the Manager, be introduced directly into the coal-gas foul main, or be passed into a weighted holder, from whence it may be admitted into the purified gas just before the station meter.

It was hoped and anticipated that the first portion of the oxy-oil gas installation would have been finished and in work by the early part of the past summer, and that thus, with the comparative leisure of that season of the year in a gas-works, and the small summer make of coal gas, it would offer full and easy opportunity for extended tests of the process. But—

> The best-laid schemes o' mice and men
> Gang aft a-gley;

and it was well on in August before the plant was got to work. But even then difficulties were not over, for by that time the coal strike had commenced, and the usual sources for coal were cut off, the regularity of working seriously interfered with in consequence, and the difficulty of obtaining reliable results correspondingly increased. Delays in the hope of a settlement of the strike proved futile; and it was therefore decided to carry out the tests without further waiting, and to take special precautions to minimize the effect of any irregularities. I wish to take this opportunity of expressing my thanks to Mr. W. R. Herring, the Engineer and Manager of the Huddersfield Corporation Gas-Works, for the freedom with which he placed his works at my disposal for carrying out these experiments, and for the facilities he has given me with respect thereto.

The oxy-oil gas plant in work was in connection with one section of the coal-gas producing plant, the gas from which passed into one holder. The oxy-oil gas could be introduced direct into the foul main, or, through a special small holder, be admitted into the coal gas after the latter left the purifiers. The enriched gas was tested between the station meter and the gasholder, where the oxy-oil and coal gases had become thoroughly mixed whichever point of introduction of the oxy-oil gas was being employed.

In order to obtain really reliable results of the enrichment effects produced by the admixture of the oxy-oil gas with the coal gas, and to neutralize, as far as possible, the effect of irregularities, I decided to make each series of tests stretch over either *one* or *two* hours, and thus include a fairly complete cycle of gas making. A 60-inch open bar photometer, fitted with a two-candle Methven screen, was used for these tests; readings being taken every minute during the duration of the test. The enriched gas was burned in each case from a standard Argand burner. A number of these series were taken at different times, so as to get some hundreds of readings; and the average was calculated from the whole of these. But, in order to ensure that the coal gas average taken should certainly not be *below* the truth, and so too favourable to the oxy-oil gas process, all unusually low readings were in this case cut out. In the case of the enriched gas, no such excision was made. By working in this way, results were obtained which, I think it will be admitted, must very closely approximate to the truth, and in which any error that there may be will tell against the oxy-oil gas enrichment process. The results obtained were as follows:—

	Average Candle Power.	Number of Readings from which Average is Drawn.	Percentage of Oxy-Oil Gas in Tested Gas.	Average Gain in Illuminating Power per cent. of Oxy-Oil Gas.
Unenriched gas	14·42	600*	—	—
Enriched gas	17·05	480	2·96	0·89 candle.
„	18·07	120	4·51	0·81 „

* With low ones cut out.

During the carrying out of these tests, Durham coal (obtained under the exigencies of the strike) was being alone used in this section of the works; and I think gas managers will therefore admit that the figure of 14·42 candles is certainly not a low one for the unenriched gas.

The rapidly increasing make of coal gas in this section of the works, necessitated by the approach of winter and short days, made the carrying out of the tests with a high percentage of oxy-oil gas somewhat difficult; and only two series, of an hour each, could be made. In these tests, the jet photometer (fed with unenriched gas) was below the average; and the result obtained is therefore undoubtedly rather lower than it should be. As a result of these experiments, we see that, for small additions of oxy-oil gas, the enrichment was at the rate of about 2¾ candles for 2¾ per cent. of oxy-oil gas; while for larger percentages certainly more than 4 candles are obtained for 5 per cent. added.

In addition to these tests, I had previously taken some hundreds of short-series tests, but abandoned them as not eliminating with such certainty the irregularity of working to which I have already referred. I may mention, however, that these tests fully confirmed the figures just given for low percentage. A large number of careful tests of the illuminating power of the total output of enriched gas were also made, when the plant was first started, and while Yorkshire coal was still being used in the coal-gas retorts. These tests, extending over eleven days, gave an average illuminating power of 22 candles for the enriched gas containing 6 per cent. of oxy-oil gas (the make of coal gas being then only about half what it was during my later tests). Assuming the illuminating power of the unenriched gas to be 16·5 candles—a figure rather above the average they had been previously obtaining under identical conditions of working and coal—the enrichment comes out at 5·5 candles for 6 per cent. of oxy-oil gas. While, since the standard of comparison was not estimated absolutely concurrently with the enrichment, this figure cannot perhaps be looked upon as *absolutely* certain, it is undoubtedly not far from the truth, and confirms what I have said as to the figures of my large percentage enrichment tests given above being probably rather low.

While, as already stated, these enriching tests have been made with the Argand burner, as the official test to which most gas managers must conform, the influence of the enrichment when the gas is burned in the flat-flame burner in general domestic use is of importance. Numerous tests have shown that the actual increase in candle power is as high when tested in the flat-flame burner as when tested in an Argand. In consequence, the percentage increase is much larger with the flat-flame burner. Thus, for instance, a 16-candle gas enriched to an 18-candle gas would show an increase in the Argand burner of 12·5 per cent. Burnt from a flat-flame burner, however, the original gas would give about a 12-candle flame, while the enriched gas would read 14 candles, or an increase of 16·6 per cent. Thus, while the gas manager was conforming to the official requirements, he would benefit his customer to an apparently much larger degree.

Some enrichment tests were carried out with plain oil gas made under identical conditions to the oxy-oil gas. Unfortunately, Yorkshire coal was at that time being worked in the sloping retorts; Durham coal still being used in the horizontal retorts of this section. This necessitated fresh estimations of the unenriched gas; and, owing to the limited number of tests which could be made, the resulting averages have not quite the same degree of accuracy as those obtained with oxy-oil gas. Still the results are certainly within one or two tenths of a candle of the truth. The results obtained were as follows:—

	Average Candle Power.	Number of Readings from which Average is Deduced.	Percentage of Oil Gas in Tested Gas.	Gain in Illuminating Power per Cent. of Oil Gas.
Unenriched gas	15·92	120	—	—
Enriched gas	17·79	150	3·02	0·61 candle.

This result, agreeing as it does with numerous tests which I have made on a small scale, proves conclusively, in my opinion, that the enriching power of oxy-oil gas is much greater than that of oil gas made under similar conditions, but to which no oxygen has been added.

It has been mentioned that arrangements have been made at Huddersfield to enable the oxy-oil gas to be admitted to the coal gas either at the foul main or after the purifiers. With a view to try and determine whether either of these modes has an advantage in enriching results over the other, the oil gas in the low percentage experiments was in some tests admitted at the one point, in others at the other point. No appreciable difference could, however, be observed in the results obtained. In the high-percentage tests given in the table, the oxy-oil gas was in each case admitted through the special holder to the purified gas, while in the early 6 per cent. enrichment tests mentioned, the oxy-oil gas was added at the foul main. This would tend to point to the admission at the foul main giving the better results; but the lower result when working through the holder may also be partly accounted for by the possibility (as I shall explain later) of the oxy-oil gas made into the holder containing traces of air.

If the enriching effects are the same whether the oxy-oil gas is admitted to the crude or the purified gas, the mode to be selected will depend on the particular needs of each gas-works. The admission by the foul main has the advantage of doing away with the need and cost of a separate exhauster and gasholder; while, on the other hand, the admission to the purified gas gives the manager greater facility in regulating the enrichment as needed. In connection with the good results at Huddersfield with foul-main enrichment, it must be borne in mind that a small quantity of oxygen is being added there to the crude coal gas before the purifiers, to revivify the latter *in situ*. Where no such use of oxygen is made, the purifiers would undoubtedly abstract some of the oxygen from the oxy-oil gas and detrimentally affect the enrichment results, unless a larger proportion of oxygen were added to the oil gas.

Turning for a moment to the question of the cost of enrichment by oxy-oil gas, we find very favourable results. Assuming 15-candle gas as costing 14d., we get—

$$\begin{array}{rl} 97{\cdot}5 \times 14\text{d.} & = 1365 \\ 2{\cdot}5 \times 42\text{d.} & = 105 \\ \hline 100{\cdot}0 \times 14{\cdot}7\text{d.} & = 1470 \end{array}$$

This gives a cost of 0·7d. for a gain of 2¾ candles, or 0·31d. per candle enrichment, or less than ½d. This figure is far below the cost of enriching by any process at present in use.

Several kinds of oil have been tried at Huddersfield; Russian Solar Distillate and common Scotch "blue" oil, both of ·87 to ·88 sp. gr., giving better results than oil of lighter gravity. The yield of oxy-oil gas has been 100 cubic feet per gallon of oil, or about 25,400 cubic feet per ton. I have already mentioned, however, that insufficient retort power for cracking the residuals

was provided in the first bay, and in consequence some residual has been wasted as regards oil-gas making—it has been used on the coke as boiler fuel. When the new bays are working, and all the residuals can be used up, the above-mentioned yield will certainly be increased. The coke produced has not been more than 5 per cent. of the oil used.

Similar difficulty has been experienced in getting, up to the present, the true illuminating value of the oxy-oil gas made; for, when working into the special holder, a special exhauster has to be employed. This, while suitable for the 8000 to 10,000 cubic feet per hour for which it is intended and arranged, becomes very difficult to regulate to a steady gauge when the make is only (say) about 1500 cubic feet per hour. In consequence, the retorts and condensers are occasionally temporarily placed under suction, with the probability of small quantities of air being drawn in, and consequent reduction of the illuminating power of the oxy-oil gas. When working into the foul main, connection is simply made by a valve with the coal-gas mains before the general exhauster; and the oil-gas retorts can then be maintained under a steady level gauge. This may, as already mentioned, be in part the cause of the somewhat lower results obtained with the 4·5 per cent. enrichment tests. The gas tested from the holder showed a candle power of from 65 to 70—a much lower result than should be obtained from Solar Distillate or "blue" oil, or than will certainly be obtained when more oil-gas benches are in work.

Many tests of the stability of the oxy-oil gas *per se* were made; and all showed the gas to be remarkably permanent. In one case, about 500 cubic feet of oxy-oil gas of 67·7-candle power were left in a 3000 cubic feet holder during a cold, but not actually frosty night; but photometric tests showed no loss of illuminating power. A prolonged test was made, during a spell of cold weather, on about 500 cubic feet of oxy-oil gas, which was kept for a week and tested each day. The results were as follows:—

Date.	Time of Test.	Candle Power.	Kind of Weather.
Oct. 30 ..	5.30 p.m. ..	64·8 ..	Keen frost.
„ 31 ..	11.30 a.m. ..	64·2 ..	Boisterous, cold, and wet.
Nov. 1 ..	5 p.m. ..	63·6 ..	Moderately cold.
„ 2 ..	11.30 a.m. ..	63·5 ..	Mild.
„ 3 ..	10 a.m. ..	63·5 ..	
„ 4 ..	5 p.m. ..	62·7 ..	Keen frost.
„ 5 ..	3 p.m. ..	62·0 ..	Keen frost during night; wet morning.
„ 6 ..	10 a.m. ..	61·2 ..	Keen frost.

Thus, with this very severe treatment—the gas in a 3000 cubic feet holder being, in the end, reduced to about 300 cubic feet—the loss in seven days of cold weather was only 3·6 candles, or 5·55 per cent. All these tests prove oxy-oil gas to be extremely stable; in fact, more so than coal gas.

No really thorough tests have yet been possible at Huddersfield of the travelling powers, through long distances of mains, of coal gas enriched with oxy-oil gas. Mr. Herring tells me, however, that, during the time the coal gas containing 6 per cent. of oxy-oil gas was being supplied to the town, he could detect no loss of illuminating power at his house, about two miles from the works. But numerous tests on the stability of coal gas enriched with oxy-oil gas during the cold weather of last winter leave no doubt in my mind of the result of practical working. The coal gases used varied between 12 and 16 candle power; and these gases were enriched with 5 as well as with 10 per cent. of oxy-oil gas of about 80-candle power. The illuminating powers of the unenriched and of the 5 and 10 per cent. enriched gases were all carefully tested on the photometer, and then the three gases were left over water, in 6-feet bell holders, for two days; being subject meanwhile to great changes of temperature, and at times to temperatures below freezing-point. These conditions were very severe—probably far severer than any to which coal gas is subjected in Great Britain. Several such series of tests were taken, and the average loss of illuminating power was as follows:—

For the unenriched gases	1·35 candles.
„ gases containing 5 per cent. of oxy-oil gas	0·95 „
„ „ „ 10 „ „	0·50 „

These results show that not only is the enriched gas not less stable than the unenriched, but that enrichment by oxy-oil gas even increases the stability of the original coal gas.

Summarizing the results I have just described, we find that—

(1) The addition of oxygen to oil gas (preferably while the latter is still hot) not only increases the illuminating value of the oil gas when it is burned *per se*, but also when it is used for purposes of enrichment.

(2) Oxy-oil gas is a highly permanent gas, and, when used as an enricher of coal gas, actually increases the stability of that gas.

(3) Enrichment of coal gas by oxy-oil gas would cost about ⅓d. per candle per 1000 cubic feet.

It is needless for me to review the relative costs and merits of the various modes of enriching coal gas at present in use, or which have been suggested, as this subject has been so often discussed of late, and is well known to gas managers. The facts which I have been able to lay before you speak for themselves; and, in my opinion, they undoubtedly place oxy-oil gas at the head of the enriching processes yet known, and fully justify the favourable view of the process which I enunciated in my former paper.

[At the conclusion of the paper, Dr. Thorne, by means of some cylinders of oxy-oil gas and coal gas, demonstrated to the members the difference in the light afforded by them. In doing this, he remarked that the cylinders of oxy-oil gas contained respectively 15 and 20 per cent. of oxygen, compressed to a pressure of about eight atmospheres. He was able to show these in comparison with ordinary coal gas—burning, for instance, through a No. 5 Bray burner. There was not a good pressure of gas; so that the result with the ordinary coal gas was not quite as it should be. He showed the oxy-oil gas burning through No. 1 Bray burners, and the coal gas burning through No. 5 Bray burners. The pressure was only about 8-10ths of an inch; but the gas was passing through a meter, so that the members could see roughly the relative rates of consumption of the coal and oxy-oil gas. Of course, he said, a gas containing 15 per cent. of oxygen lost under compression about 10 per cent. of its light. He had also a gas containing 20 per cent. of oxygen, which he would burn in larger (No. 4) burners; and these would give an idea of the character of the flames with the greater percentage of oxygen. Of course, these flames were rather too large for an oil gas. He had chosen a No. 4 Bray burner in preference to a No. 3 (which would have suited the oxy-oil gas better), because he wanted to turn on the coal gas to this burner in place of the other; and although the test was then against the coal gas, it was not so much against it as if they were using a No. 3 burner. They would see by this the character of the large flame; and it would be noticed that one characteristic was the much smaller sized dark space compared with the size of the flame than in the case of coal gas. This oxy-oil gas would burn with a much pleasanter flame from a No. 3 burner. He might mention that, with the gases burning from the same burners and under the same pressure, the relative rate of consumption would be about 5 cubic feet of oxy-oil gas to 7 cubic feet of coal gas. It would be seen by the meters that the quantity of coal gas burnt was about 10 cubic feet, whereas the amount of oxy-oil gas consumed was about 4 feet; so that they were burning about two-and-a-half times as much coal gas as oxy-oil gas. The difference, however, in the illuminating power was much to the advantage of the latter. Under favourable conditions, when made and burnt carefully, the result was eight or nine times in favour of oxy-oil gas.]

Discussion.

The PRESIDENT said that, whether judged by the importance of the subject, its careful preparation, or the number of points with which it bristled, the paper which they had just heard was a most interesting one; and the best compliment they could pay to Dr. Thorne, and the best thanks they could give him, was that they should adequately discuss the subject.

Mr. W. A. VALON (Ramsgate) said Dr. Thorne and he had been associated together for a long time; and he knew him to be such a careful experimenter, and so anxious as to his facts, that he felt a certain amount of hesitancy, reading this paper for the first or second time, in coming to a conclusion not quite on all-fours with the author. If the facts were as they appeared to him to be in the paper, he could not quite follow the whole of them; and he could not yet bring his mind to think there was any great share of the good results due to the oxygen itself. He (Mr. Valon) should have liked very much, if it had been possible, to have had the effect of mixing oil gas pure and simple—without oxygen—with the coal gas; and, in the next place, he should have liked to have had it stated in the paper what was the amount of oxygen found in the purified gas after it had passed to the holder, and before it was sent into the mains. He found that Dr. Thorne said he mixed with the Huddersfield gas 5 per cent. of oxy-oil gas; and this 5 per cent. of gas had to contain 15 per cent. of oxygen. Now, taking the make of gas as given to him (Mr. Valon) at Huddersfield, or any make, if it was to be 5 per cent. that had to be mixed to raise the illuminating power to a certain point, then the 15 per cent. of oxygen mixed with the 5 per cent. of oxy-oil gas made for the whole 0·75 per cent., or rather less than he was using at Ramsgate for purification alone. As he had remarked, he had proved, certainly to himself, by careful experiments, that there was no doubt a slight excess of oxygen in the purified gas was advantageous; and it must be a slight proportion. But in this case his mind was perfectly clear that, if only that quantity of oxygen was put in with the oxy-oil gas, and introduced into the foul main, not any of it would find its way into the gasholder. He saw later on in the paper that Dr. Thorne admitted it was possible a quantity would be taken out in the purifiers. If the 5 per cent. of oxy-oil gas was introduced in the foul main, then it was considered that nothing would be wanted further for the action of the purifiers; but, in that case, he (Mr. Valon) submitted to Dr. Thorne that the *whole* of the oxygen put into the foul main would be abstracted in the purifiers, and there would be none left in the gasholders. This was why he would have liked an analysis of the gas, to know how much free oxygen there was there. Referring to the system of putting in oxygen in the foul main, of course the members were aware that he (Mr. Valon) had made many hundreds—he was going to say thousands—of experiments in that direction. He found that, while at Ramsgate, and at other works, they were putting in 0·6 per cent. of pure oxygen for purification when the sulphur equalled 600 grains, if they put in this oxygen at the foul main, instead of at the entrance to the purifiers, they used a larger

amount with a very much less result. Now they saw the bearing of this point. He would show how he was able to prove this by an absolutely practical experiment made within the last two years. Two years ago, when the Association visited Ramsgate, they were putting oxygen into the gas—drawing it through the exhauster; and they were exhausting at that time through the condensers and the scrubber. The consequence was they were able to take their oxygen in at the exhauster, and not send it through the washer and condenser to the purifiers. In the course of making some alterations about two years ago, they had to remove the scrubber and condenser, and they had to put them on the other side of the exhauster. The result was they had to increase their percentage of oxygen to such an extent that the oxygen apparatus could not produce the quantity they required for purification. A large amount of the oxygen was absorbed by the scrubber. He presumed that, by putting the scrubbing, washing, and condensing apparatus in front of the oxygen, they lost a large quantity of it; and they then introduced a steam jet to bring the oxygen into the inlet of the purifiers. Directly they did this, they went back to the same quantities as before. What he wished to point out was that this raised in his mind a doubt as to whether there was anything left of the oxygen, mixed with the oxy-oil gas in the foul main, after it passed the purifiers; and he should like Dr. Thorne to give them the amount of free oxygen that was in the gas after it reached the holder.

Mr. W. R. HERRING (Huddersfield) said that Mr. Valon had been making some remarks in comparison of oil gas alone and the oxy-oil gas. He might say that he had ventured once to run the apparatus with oil, and shut off the oxygen; but within 24 hours they got so thoroughly choked, that he thought it better, so as not to add further to his troubles, to let the oxy-oil process, as they worked it at Huddersfield, be judged by the ordinary oil-gas processes as used in other towns. They found they could not keep their apparatus clear when making oil gas alone. Another thing was they found, in the condenser, that they got among the condensation a very light spirit, highly volatile; and he thought that, by usually running the plant for oxy-oil gas, and then for one day using it as a simple oil-gas plant, there was every possibility that this light vapour was taken up by the oil gas, and so enriched—thus giving a result more favourable to the oil gas than otherwise would be the case. With regard to Mr. Valon's remarks respecting the admission of the oxy-oil gas in the foul main, he might say that, whenever they were using it in the foul main, they admitted, practically speaking, 0·8 per cent. of oxygen at the inlet of the exhauster. With regard to the process itself, probably some of the gentlemen present were at the recent meeting of the Society of Engineers, when Professor Lewes read a paper on "Gas Substitutes;" and, in the course of the discussion, he (Mr. Herring) referred to what they were doing at Huddersfield.* They had then been running the oxy-oil gas process for only about a fortnight. It was still working with equal satisfaction; and the results now quoted by Dr. Thorne fully confirmed those obtained at the beginning. As soon as they had the large plant working, he was in hopes of getting one candle per cent. of enrichment. He might also make a few remarks with reference to the difficulties met with during Dr. Thorne's experiments. They had had considerable trouble in their neighbourhood with respect to coal. They were in the habit of using a large proportion of Silkstone; it was the cheapest for them. But since their stock had run out, they were obliged to substitute a supply from Durham, which was fully 2 candles inferior to the coal they had been working; and there were days and parts of days during which they were using nothing but Durham coal, and then they would take in perhaps 50 or 60 tons of Yorkshire coal. At the same time, any very low readings which were obtained with the unenriched gas were struck out, in order to tell rather against the process than in favour of it. They would be very pleased for any gentlemen interested in the matter to visit Huddersfield, and prove the results for themselves.

The PRESIDENT said he was sure Mr. Herring would kindly supplement his remarks on one or two points which seemed to be of interest. One was with reference to his inability to make the experiments which Dr. Thorne had touched upon in his paper—of working an oil-gas plant independently of the oxygen. He understood he had some difficulty, owing to the apparatus blocking up. In what way did the apparatns employed for making oil gas give such trouble? Then, with regard to the point at which the oxy-oil gas was mixed with the coal gas, Mr. Herring got over the difficulty of the absorption of the oxygen by the purifiers by the admission of 0·8 per cent. of oxygen, which the purifiers absorbed, and therefore left the oxy-oil gas perfectly free. He should like to ask whether Mr. Herring used lime for purifying, and whether he was working for sulphur compounds; or whether he was using oxide, and only extracting the sulphuretted hydrogen.

Mr. HERRING said, regarding the first question, as to the choking of the apparatus when running with oil gas alone, he might say that they had no hydraulic main. They collected the gas, and took it direct to the inlet of the condenser. Immediately at the top of the retorts, in front of the arch, they had a rising pipe, which was the only ascension-pipe. There was a bend at the top about 8 feet from the ground. From there they had probably 8 to 10 feet of pipe leading to an annular water condenser. They found the plant got choked up with a thick tar when running with the oil gas alone; and they had had numerous difficulties one way and another. He had had no time to devote to small details; and so he did not think he need trouble to run oil gas alone. There were other processes by which they could compare the oxy-oil gas. The plant was choked up principally with tar, but probably that might have been soot saturated with the condensed oils. With regard to the admission of oxygen to the purifiers, he had forgotten the pith of the President's remarks.

The PRESIDENT said, as he understood Mr. Herring's remarks, 0·8 per cent. of oxygen was admitted apart from the oxy-oil gas, and that oxygen was absorbed by the purifiers. Therefore, the purifiers did not reduce the value of the oxy-oil gas. Did Mr. Herring use oxide of iron or lime purifiers? Supposing oxy-oil gas were admitted in the foul main in using lime, they would want to put so much sulphuretted hydrogen in the lime vessels that they would not be able to purify for sulphur compounds at all.

Mr. HERRING said they had four oxide boxes and two lime, and the sulphur compounds ran between 25 and 30 grains; they did not run over when using the oxygen. Practically speaking, the results obtained were the same whether working with a percentage of oxygen in the purifiers, or admitting the oxy-oil gas into the foul main, or *per se* into the meter.

Mr. FRANK LIVESEY (London) said that the only thing to which he wished to refer in connection with the paper was that they all ought to investigate this method of enriching gas at ½d. per candle per 1000 cubic feet, because he believed Dr. Thorne had proved it to his own satisfaction. If this was the case, he thought they ought all of them to investigate it—this very low rate being cheaper than the enrichment of gas had even been done at before. But this also brought upon them the responsibility of making not only oxygen but oil gas. Most gas managers had quite enough to do at the present time; and he did not think they would want to add to their troubles. He was therefore afraid this would deter them, if they consulted their own feelings as to whether or not they should adopt this plant, which had been put before them in a very favourable light. The point he wished to bring out was that he believed nothing had been added for interest on the plant. [Dr. THORNE: It has.] He did not gather so from the paper. Of course, this simplified it still further.

Dr. THORNE: The oxygen royalty has been included, but not the process royalty.

Mr. LIVESEY: At any rate, it would not add much to the ½d.

Dr. THORNE: I have not gone into the business in that connection; but, from what I know of the people who have this matter in hand, they would not add a royalty which would seriously interfere with its introduction.

Mr. LIVESEY: Did I understand you that the oxy-oil gas was put in before or after the purifiers?

Dr. THORNE: Both.

Mr. LIVESEY: Is the gas perfectly free from sulphuretted hydrogen?

Dr. THORNE: Yes.

Mr. LIVESEY: Then, from the discussion which has followed the paper, I do not see why the gas should be put into the foul gas at all, because you must lose some of your oxygen.

The PRESIDENT: That is got over at present by putting in sufficient oxygen to absorb all the sulpuretted hydrogen.

Mr. C. GANDON (Lower Sydenham) said the paper was, to him, exceedingly interesting, because it cleared up a doubt that was in his mind before as to what really this oxy-oil gas process might be. Now Dr. Thorne started by saying that it practically resolved itself into the addition of oxygen to the gas. He had had the opportunity of seeing the small apparatus which was at work in London, and the same idea struck him—that the only principle involved was the addition of oxygen. He thought this was what the paper dealt with; while the oxygen rendered the gas more permanent, and also prevented the deposition of such tarry matters as Mr. Herring had referred to. He was not in a position to express an opinion on this point; but, if it did that, it would be a great advantage, because, in all the experience he had had of making gas from oil, this had been one of the difficulties—the choking of the apparatus. If the oxygen would prevent this, that alone would be worth using it for. As Mr. Livesey had pointed out, this process involved two sets of apparatus—the oxygen-generating plant and the oil plant. This was enough to frighten some of them, as perhaps it had frightened Mr. Livesey. Gas managers had now pretty nearly enough to do to make coal gas; but still he thought they would all follow these experiments at Huddersfield with a great deal of interest, though he did not think as yet they were beyond the experimental stage. When Mr. Herring was in a position to enrich all his gas by this process, he would like to pay him a visit; but at present, with the diversity of coal which he had been using and one thing and another, he hardly thought he had got beyond the experimental stage. As he (Mr. Gandon) gathered from the paper, the advantage so far as illuminating power was concerned in using oxygen was not so very great. He thought that in one place, Dr. Thorne gave about 0·83 of a candle per cent. of the oxy-oil gas—5 per cent. of oxy-oil gas gave 4 candles increase of illuminating power. Now, if he worked it out with this experiment which Dr. Thorne gave on plain

* See *ante*, pp. 629, 575.

oil gas, he (Mr. Gandon) made out that 5 per cent. would yield about 3 candles increase of illuminating power. Therefore, there was about 1 candle in favour of the oxy-oil gas; or (say) 25 per cent. He did not know whether he was correct in looking at it in that light; but, if not, perhaps Dr. Thorne would put him right. One other point was as to the quantity of coke which was the ultimate residual that was produced. He had heard that in the Young process, for instance, they had something like 25 per cent. of coke left. Now in this process there was only 5 per cent. What was the reason of this difference—was it due to the oxygen? In connection with this oil-gas question, there was another little point; but he did not know whether it was altogether pertinent to the paper. It was the effect of adding rich gas to poor gas in bulk. Suppose they took 100 feet of ordinary gas, and added to it 10 feet of 80-candle gas, would they obtain 110 feet of gas? His experience was that they would not. Mr. Watson, who was present, had been lately making some crude experiments on this point; and perhaps he could give the members some information about them. These experiments pointed to the fact that one did not get 10 feet increase. In Field's Analysis, it was stated that 75 feet of oil gas could be obtained from a gallon of petroleum spirit; but would they get 75 feet more to sell? He thought not.

Mr. J. C. Watson (Lower Sydenham) said he had been trying some crude experiments for the purpose of seeing what the result would be of adding a gas of a high specific gravity to poor gas. He took some portions of carburine vapour; and he found that, by adding 2, 5, or 10 per cent. to poor coal gas, he did not get the volume with which he started. He worked in this way: He took 99 volumes of gas, and put in 1 volume of carburine vapour. After this had been stored for 24 hours, there was a decrease of ½ per cent. in the bulk. Then he took 98 volumes of coal gas, and added 2 volumes of carburine vapour; and he again found a decrease in the bulk after being stored for 24 hours. But when he took 90 volumes of coal gas, and got up to 10 per cent. of carburine vapour, he found there was a diminution in bulk of nearly 4 per cent. He had very crude apparatus to deal with; but he checked the results by the eudiometer, and he found the returns were practically the same with the two apparatus. He did not place very much reliance upon the results, because they were rather more than he expected. But still it would be interesting if Dr. Thorne could enlighten the members as to what the percentage of added gas would be—that was to say, whether, by the addition of oxy-oil gas, they got an absolute volume or not.

The President remarked that the experiments which had been carried out by Mr. Watson depended very much for their accuracy upon the means adopted for measuring the portion of carburine vapour added to the original volume of coal gas.

Mr. Watson said he took a glass measure which contained about 50 cubic inches of coal gas. This was a graduated measure, and he put it over water in the form of a gasholder; and the carburine vapour was allowed to percolate into the holder. A reading was then taken; and then the whole thing was allowed to cool for 24 hours, after which another reading was taken.

Mr. J. W. Helps (Croydon) said that some two months ago, he obtained an introduction from a friend to the Oxy-Oil Gas Company; and shortly afterwards he went to their offices in Salisbury Square, where they had an experimental plant, and what he saw there was very similar to what Dr. Thorne had shown them that day. After seeing photometrical tests, and reading reports in which it was stated that gas could be enriched at a cost of ¼d. per candle, it struck him that the process was worth looking into. He brought the matter before his Directors, and obtained their permission to investigate it. During the past five weeks, he had had a good many opportunities of doing this; and he had to thank the Oxy-Oil Gas Company for the facilities they had afforded him, both in London and at Huddersfield. He spent some days at the Salisbury Square testing-place in carrying out a series of experiments; and he immediately followed this up by visiting Huddersfield. He could bear out what Dr. Thorne had stated as to his experiments having been carried out, for some time, under considerable difficulties. Since then he had been back in Salisbury Square making other experiments; and perhaps they would think it rather strange that, having had a fair amount of experience, he was not yet prepared to lay before the members figures proving the matter one way or the other. It seemed to him that a subject of this kind ought to be tackled in such a way that a certain amount of definiteness could be arrived at in five weeks. He had not finished his experiments; and therefore he could only give the results rather generally than with any detail. Both at Huddersfield and at the Salisbury Square testing-place, he had made oil gas and oxy-oil gas; and he had, over a considerable number of tests, compared the results. He could safely say this, that they seemed to bear out very nearly the results that Dr. Thorne had given them in his paper—that was to say, that, with 5 per cent. addition of oxy-oil gas, he had obtained an enrichment varying from 3½ to 5½ candles; while, with oil gas alone, he had never succeeded in reaching more than 3½ candles enrichment. It was quite possible at times, however, to find that they got experiments in which oil gas would show a better result than even oxy-oil gas. But it would not do to depend upon one experiment alone; and the mean result of the tests he had made, he had given roughly in the figures just quoted. There was one point he should like to mention with reference to a rather curious experiment which he made a few weeks since at Salisbury Square. He took some ordinary enriched gas, and divided it into two portions, and put them into two small holders. He carefully tested them, and found their candle power. He then added to one of them 5 per cent. of oxy-oil gas, and then allowed it a few hours to diffuse; and he found he had added a little under 4 per cent. of enrichment. He then left these two holders sealed up (in sealed and stamped rooms) for some days; and, when he returned, he found the coal gas had lost a considerable amount of its illuminating power, while the oxy-oil gas, with the 4-candle enrichment, had only lost about 0·4 candle. He then added to the impoverished gas 5 per cent. of oxy-oil gas; and from this he obtained a result infinitely higher than anything he had realized before. He did not want to say that the coal gas had deposited certain hydrocarbons on the face of the water or the sides of the holder which the oxy-oil gas picked up, and allowed to be introduced as illuminating power; but the fact remained that he obtained as enrichment something like 5½ candles. He was only at Huddersfield three or four days; but while he was there, he tested the oxy-oil gas both ways—he admitted it at the inlet of the meter, and also on the hydraulic main. Although he should not like to say, with a small number of experiments, that they were perfectly correct, yet he found, in those experiments, a higher result when he admitted the oxy-oil gas at the hydraulic main than when it was admitted at the meter. In conclusion, he could not help saying that it seemed to him a great reproach to an industry so large as theirs, that they had not at their disposal a gas-works based on commercial principles in the first place, but with its main object that of providing apparatus and skilled assistants, chemists, and engineers, who were prepared to take part in and thoroughly test such processes as this one, but under better circumstances than Dr. Thorne had been working. There must be something in processes of this kind when they had a chemist like Dr. Thorne bringing before gas managers such a paper as he had read that day. Why should not gas companies combine together to provide the means for testing these processes?

Dr. H. W. Salomonson (Amsterdam) said that in his paper Dr. Thorne had given them a great number of facts and figures which led him to conclude that the arguments against the oxy-oil gas process could never be maintained; but the arguments against it convinced him that there was a difference of opinion as to the essential question, What is oxy-oil gas? Dr. Thorne always spoke of the gas as it was made by the Tatham process; while Professor Lewes made a mixture of oil gas and oxygen. Professor Lewes took oil gas and tested it; then mixed it with oxygen, and tested it again; and then enriched poor coal gas with both. But it was impossible to test oil gas the moment it came out of the retort, before having passed the condenser, and while it was hot; and yet in the Tatham process it was claimed that the oxygen had to be mixed with the oil gas in that state, in order to obtain all the advantages of the process. If this fact was not taken into consideration, they could not expect results that would be obtained by the oxy-oil gas; and differences would, of course, arise. He had recently had to investigate the oxy-oil gas for a Syndicate, and his own opinion was that there was a great difference between the production of oxy-oil gas and making a mixture of oil gas and oxygen. He had made oil gas without oxygen, and obtained the following results (taking the oil in pounds and not gallons):—

	Gas. Cub. Ft.		Candles.		Candles.
1 lb. of oil gave	8·965	of	61·6	=	110·5
" " "	10·0	"	57·7	=	115·5
" " "	11·1	"	51·2	=	113·5

It would be seen that there was a considerable difference in the illuminating value of the gas. In one experiment, it was as low as 51·2 candles, while in another it was 61·6 candles; but there was very little difference as to the number of candles per pound of oil. Then he made (as far as possible under entirely similar conditions) oil gas, but added oxygen at the moment the oil gas was coming out of the retort, and while it was hot. The oxygen was added to the extent of 15 per cent. of the volume of the gas expected to be obtained:—

	Gas. Cub. Ft.		Candles.		Candles.
1 lb. of oil gave	13·06	of	66·5	=	173
" " "	12·66	"	68·7	=	174

These figures showed that the addition of 15 per cent. of oxygen gave an increase of more than 50 per cent. of illuminating value to the gas. These results were not obtained by making a gas of higher illuminating power, as, for instance, he made an oil gas of 61·5-candle power, and an oxy-oil gas of 66-candle power, which was only an increase of 8 per cent. of illuminating power. This meant that the oxy-oil gas was made at a higher temperature probably than the oil gas, yet they obtained an advantage of 50 per cent. of increase in illuminating value. In the second experiment, which was perhaps made at a somewhat higher temperature, he produced a larger volume of gas, and yet the number of candles produced from 1 lb. of oil was the same, but was, in fact, 50 per cent. higher than he found in making experiments on oil alone. He made this point because he thought that Dr. Thorne seemed to find a great deal in the fact that oxy-oil gas had a considerably higher value than the oil gas, and that there was an advantage in making the oil gas at a lower temperature.

The 50 per cent. increase was not, of course, pure profit, as they had to add 15 per cent. of oxygen; but he made out the value of the oxygen as about equal to that of 55 to 60 candle oil gas. They could calculate that 1 lb. of oil gas equalled 115 candles, and, adding 15 per cent. to it, they obtained 132·5 candles. Taking the gas from 1 lb. of oil *plus* 15 per cent. of oxygen, they found 173 candles, instead of 132; and that was a pure profit in value of 30 per cent. increase in the candles by the addition of oxygen. He thought this was the way to test the value of the addition of oxygen as far as the formation of the gas was concerned. These figures showed that the Tatham process meant something more than the making of a simple mixture of oil gas and oxygen; and he would oppose to the experiment required by Professor Lewes this one: Take oil gas, test it, mix it with 15 per cent. of oxygen, test it again, and then see whether or not the mixture had increased by as much as 50 per cent. in illuminating power. He did not suppose it would show such an increase; but it would indicate that there was a difference between making oxy-oil gas and a mixture of oil gas and oxygen. He then proceeded to refer to the experiments made by Wibel some 15 years ago, which showed that, if air was mixed with gas as in the Bunsen burner, the illuminating power of the flame was lost—not on account of the oxygen in the air, but in consequence of the debasement of the temperature in the inner part of the flame. Wibel said: "It is extremely difficult to annihilate the illuminating power of the flame by oxygen, and that only takes place if such an excess of oxygen is added so that the flame would be cooled. Under favourable circumstances, there will be a considerable increase in illuminating power." Such observations would make it *à priori* improbable that the addition of 5 per cent. of oil gas to poor coal gas would debase the illuminating power of the flame. But the question could be decided by experiment; and to compare the enriching power of oil gas, they had to know whether these gases developed their full illuminating power in the enriched gas, or perhaps more or less. He had found that, if coal gas was enriched with oil gas, that the candle power of the mixture was only very little higher than would be expected by calculation. But by making a 12½-candle coal gas, and adding 5 per cent. of oxy-oil gas of 66-candle power, they could calculate upon a gas mixture of 15·3 candles certain. He could not therefore agree with Professor Lewes that the oxy-oil gas would overdo the combustion; and he thought his figures clearly showed that the oxy-oil gas had considerably more enriching power than would be calculated from the photometric tests of the gas *per se*. Considering this fact, in addition to the 50 per cent. increase in illuminating power which was obtained by adding 15 per cent. of oxygen, he was sure that the oxy-oil gas process was a great improvement; and he could understand the good results obtained at the Huddersfield Gas-Works. But a conclusion had been come to here which he did not think was entirely right. They had obtained very low figures at Huddersfield and Salisbury Square as the cost of enrichment for oxy-oil gas; and these had induced to comparisons of several other enriching processes with the oxy-oil process in favour of the latter. Before concluding, he wished to make a distinction between the oxy-oil gas process and the Tatham process. He considered the Tatham process to be a new principle that could be adopted in a great number of cases—the addition of oxygen making a rich permanent gas from liquid hydrocarbons. Dr. Thorne had proved the value of this principle in one special case—in the oxy-oil gas process; and he would agree that he had proved that no other enriching process at present known could enter into competition with oxy-oil gas in regard to cost of enrichment. But he understood that it was to the Tatham process—to the addition of oxygen—that they were indebted for these results. Would it not, he asked, seem very probable that the same advantages could be obtained in all processes and in all cases where, just as in the oxy-oil gas process, liquid hydrocarbons were transformed into rich permanent gas? He did not speak only of the Young, but of carburetted water gas, and other processes, where oils were retorted, as well as in the Maxim-Clark process, where they were evaporated by heat, and made a rich gas; and experiments would have to decide whether there were not as favourable conditions in these, as in the oxy-oil gas process, for the addition of oxygen. He would be inclined, until experiment convinced him to the contrary, to look upon the Tatham process not as a competitor, but as the most valuable support for these enriching processes, and as able to raise their value up to the oxy-oil gas process. He therefore thought they must make a distinction between the Tatham process and its first successful application—the oxy-oil gas process.

Professor LEWES said he had listened with intense interest to the paper. He had a personal interest in this subject, because, early in October, he read a paper before the Society of Engineers, in which he made the statement that the illuminating value of oil gas could undoubtedly be increased to a large extent by adding oxygen to it; but he also said that, if the oxy-oil gas was used for enriching poor coal gas, they would not find that the enrichment which was produced would be greater than the enrichment produced by using oil gas alone. He simply repeated that, because he had seen nothing whatever in Dr. Thorne's paper, or in the views which had been expressed by other gentlemen, to induce him, for one moment, to recede from that position. Nay, more, he could say that Dr. Thorne, who was an old scientific and personal friend of his, had carried out the bonds of friendship by proving, in his paper, the truth to a considerable extent of that remark. In the first place, there were in the paper a number of trifling points to which he might have alluded; but there would not be time for him to enter into small criticisms, so that he might as well save time by plunging into the main question. The concluding paragraph in the paper was a paragraph which he regretted more than any other. In thus bating the most important question from their point of view, Dr. Thorne made a mistake. He conceived that it was with certain other processes at present in vogue that this oxy-oil gas process must stand or fall. They had at the present time a glut of enrichment processes. They had, for instance, a trusty friend in the Maxim-Clark process, which could be relied upon for a couple of candles when the gas in the holders had fallen to a low point. But the Maxim-Clark system could not compare with the oxy-oil process, or with any oil-gas process pure and simple. It was with the Young oil-gas process that the oxy-oil gas system must measure its strength. They had records of what had been done by oil gas; and turning back to a report made by Mr. Linton, the Engineer of the Leith Gas-Works—a gentleman whose utterances were quite as reliable as any they could have from other sources—they found some figures which must, however, be translated before they could see the whole force of them. Regarding the present question, Dr. Thorne's experiments (like everything else he took in hand) had been carried out in a most careful and painstaking way; and they found that for 1 per cent. of oxy-oil gas added in one case he obtained an enrichment of 0·89 candle, and, in a second set of figures, he had 0·81 candle. They might take the result of the whole experiment, therefore, as 0·85 candle. Turning then to Mr. Linton's report upon the Young oil-gas process, they found some very interesting figures. Mr. Linton took coal gas, and mixed it with oil gas; and he found that the mixture had a candle power of 30·46. This was not an experiment made on a toy scale, but on a large scale. The original coal gas which he started with, and which was tested carefully, was of 16-candle power; so that they had there a manifest enrichment of 14·46 candles. His figures showed that he added to the coal gas 17·1 per cent. of oil gas, which gave him an enrichment of 14·46 candles. If they divided the 14·46 by 17·1, it would be found that the enrichment figure so obtained was 8·45. In another set of experiments, Mr. Linton took poorer gas. He tested it very carefully, and found the candle power was 13·67. He mixed this with oil gas as before; and the mixture was 29·69 candles. He gave the quantities in which he added the oil gas, and the volume of the mixture which he had left behind; and they found that in this case he had added 18·5 per cent. of oil gas, and for this he obtained an enrichment of 16·02 candles. If they tried this enrichment as in the other case, it would be found that 18·5 and 16·02 gave them 0·86. If they treated these two figures as before, they had an enrichment for the Young process of 0·854. If this did not prove the statement he made, that they obtained no more enrichment result by adding oxy-oil gas than by the oil gas alone, then he was not reading the figures aright; but there they had practically identical figures for the oxy-oil gas and the Young process. He had been told that he had been using mixtures of oxygen and oil gas, and not oxy-oil gas as made by the Tatham process. All he could say was that he had been working for something like six or seven months, doing his very best to get good results; and they were never of the kind which would for one moment, without further proof, enable him to admit Dr. Thorne's statement that oxy-oil gas as an enricher was invaluable. What he had done was this: He took a retort, and while the oil gas was issing from its mouth, he mixed oxygen gas with it; and he obtained an increase in the illuminating value. This was done in no haphazard way. Dr. Thorne had laid enormous stress upon the mixing of the oxygen with the oil gas when it was hot; and he suggested that this had a most remarkable effect on the gas produced. He pointed out that the great stability and high illuminating power of the gas was really due to the mixing while hot. He (Professor Lewes), in his experiments, had a tube running from the retort; and he had double T-pieces at various intervals. In one he put a thermometer, with the bulb up to the point where the coal gas and oxygen mingled. He found that, at a temperature of 80°, the oxygen and the oil gas had no action whatever on each other as they mingled together. The oxygen and the oil gas simply mixed; and the mixture made in this way gave abundant signs that there had been no combination of any kind. The experiment was made with very great care. He remembered, in the course of a conversation on one occasion, Dr. Thorne told him that, when they mixed oxygen and oil gas together hot, they had a sort of semi-combination taking place between the two—some kind of semi-combination which enabled one to keep in the poor gas vapours which would otherwise condense out; and this gave an enormous value to the oxy-oil gas. He (Professor Lewes) was taken with the idea; there was something in that "premature engagement" between the oxygen and the vapours which tickled his fancy. When he got back to his laboratory, he started a set of experiments, in order to see how far this was carried out. Taking the oil gas as it issued from the retort, and mixing the oxygen at temperatures up to 80°, there was no chemical combination. He also found that, taking the mixture given up to the temperature of 80°, he could,

by any of the absorbents of oxygen, get the whole of the oxygen back from the mixture; and further, by placing this heavy oil gas at the bottom of a gasholder and filling it with coal gas, he had the oxygen diffusing out of the gas, which would not have been the case if there had been any semi-combination. He went on increasing the temperature to see if anything would take place at a higher temperature; and he then had oxides of carbon form. Directly he got up to about 120°, these commenced to form. The oxides of carbon meant a deterioration in the quality of the gas, and also that he was throwing extra strain upon the purifiers. In this way he came to the conclusion that this could not exist. He was very careful to mix his oil gas and oxygen hot; and this was the result. He would now give one of the results which he obtained because it was rather in favour of the process than any of his others. He took some coal gas as supplied by the South Metropolitan Gas Company, and allowed it to stand in a 400-feet holder for about a month, during which time it gradually went down until it was 11·5 candles. That holder was his store-house for poor coal gas for enrichment; and, taking a portion of it, he added to it oil gas made in this way: He put his oil-gas retort in a small furnace; and arranged the heat and flow of gas until he obtained oil gas coming off in a perfectly constant condition, so that he could rely on getting the gas of the same value every quarter or half hour. Of this oil gas, enriched with oxygen, he ran a certain proportion—10 per cent.—into an experimental holder, containing some of the 11·5-candle gas; and he found, taking care to have it thoroughly mixed, and testing it by burning every scrap of gas out of the holder, and taking the mean illuminating value as representing the value of the gas in the holder, that the 10 per cent. of oil gas had enriched the coal gas up to 16·7 candles. He then took the oil gas, issuing as it was warm, and mixed with it 15 per cent. of oxygen, and passed it into a clean holder full of the same poor coal gas, and tested it in exactly the same way; the enrichment being 16 candles as against 16·7 candles obtained by the oil gas alone. When he heard Mr. Valon's remarks, he felt there was some hope that they had obtained the key of this great secret. He (Professor Lewes) had been using, in his experiments, purified coal gas; while Mr. Herring had been putting the oxygen into his foul main, and it was the difference in the purification which was making the variation in their results. If he had used foul gas in his experiments, and then purified it, it would, he thought, perhaps have made a difference in the results; but several gentlemen who had spoken since had plucked even that crumb of comfort from him. From the experiments he had made with the greatest possible care, and which really included every suggestion which had been made to him, he was simply forced back, by Dr. Thorne's paper that day, to exactly the same footing on which he stood before—that for enriching purposes they might just as well take oil gas by itself. His desire was for sincere truth. He did not wish to upset any oil-gas plant; but if he was to believe other people's experiments rather than his own, he wanted those experiments made manifest to his senses—he wanted to be shown those experiments; and allowed the opportunity of criticizing them step by step. The paper did not contain sufficient details to satisfy him. They had been reminded by Dr. Salomonson of Dr. Wibel's experiments, which were most admirable ones when they were made. Their friend, of course, knew that in the Bunsen burner the destruction of the luminosity was due to two causes, which were acting in certain relative quantities, and which could be perfectly well measured—these two causes being first of all the oxygen; and, secondly, the cooling influence of the dilution by the nitrogen. But in referring to Wibel's work, Dr. Salomonson ought also, having gone to German literature, to have mentioned the work of some more recent observers—such as Heumann. He (Professor Lewes) was sorry he had been such a "bone of contention;" but they would pardon him for saying that he believed more in his own experiments than in those of other people.

Dr. THORNE said that time would only permit him to go briefly over the points which had been raised; and perhaps it would be simplest to take the speakers *seriatim*. Referring first to Mr. Valon's remarks, he thought, as he stated in his paper, the question of the using up of the oxygen was answered by adding oxygen to the unpurified gas; and Mr. Herring had referred to this point as well. In reference to this question, of course, he came to the point whether it was better to add the oxy-oil gas before or after the purifiers. His own feeling was in favour of adding it after the purifiers; but it was as well for the point to be discussed, and left to a great extent to the exigencies of particular works. Certainly, however, there was no doubt, he thought, that, if they put it in before the purifiers, they must have, with the oxy-oil gas, a larger percentage of oxygen to be taken up by the purifiers, so as to leave the oxygen of the oxy-oil gas to pass on. He had not been able to make experiments as to the character of the gas, the quantity of oxygen passed under various conditions, and so on. As they all knew, the carrying out of experiments of this kind took a long time; and when consenting to read this paper, he had hoped that his experiments at Huddersfield would have occupied much less time than they had done. In view of the difficulties of the coal strike, he had had to alter the whole system of investigation, and throw away the result of some weeks' work. Still he was convinced that the oxygen certainly would be taken out by the purifiers, unless additional oxygen were added in some way or other. Mr. Valon spoke of the effect of the addition of oxygen and without the addition. He agreed with him as to the advantageous influence of small proportions of oxygen, even in rich gas, when added through the purifier; but he certainly thought that they must have in the purified gas for the full advantage of the oxy-oil gas the full proportion of oxygen that was put in with the oxy-oil gas. Mr. Herring mentioned that he had used oil gas alone for some time, and got into difficulties with it. He might also mention that he quoted in his paper some short series of experiments with oil gas made in the same way that he made the oxy-oil gas, excepting the oxygen, of course; and that he obtained results which were lower. In the case of oil gas, the increase of illuminating power per cent. was 0·61 candle; while with oxy-oil gas it was 0·85, or 0·89 candle—showing an increase of 33 per cent. of enriching effect, due to the addition of the oxygen. He thought the President's remarks were answered, and referred more particularly to Mr. Herring's work, so he did not think it needful to take up further time with regard to that. Mr. Frank Livesey spoke of the difficulty of making oxy-oil gas in addition to one's ordinary work; but he had no doubt this was a difficulty that gas managers would be very glad to get over. Other difficulties—for instance, the cost of cannel—were becoming so great that it was a case of "Hobson's choice;" and something would have to be done. If they could not use cannel, they would have to employ something else which perhaps was not quite so convenient. His experiments certainly showed that, besides the matter of cost, there was also the question of greater stability, because, although he was speaking before a rather formidable audience of gas experts, he still had little hesitation in his mind in believing that cannel enrichment was not by any means an absolutely permanent one; nor were a great many of the other enrichments that were at present used. They answered very well for their purpose up to a certain point; but there were a great many of the enrichment processes which lacked the great point of permanency. Mr. Livesey spoke of the sulphuretted hydrogen. He (Dr. Thorne) had tested the gas made from Solar Distillate and Scotch shale oil, and found it entirely free from sulphuretted hydrogen; and in that case therefore, as far as the question of purity went, it was as advantageous to put it into the purified gas as into the foul main. He agreed with Mr. Gandon in his statement that the essence of the oxy-oil process lay in the addition of oxygen to hydrocarbon gas—a point which was touched to a much greater degree by Dr. Salomonson. Mr. Tatham had always insisted that oxy-oil gas was only one of the applications of his process. There were numerous others for using the process, and he mentioned them briefly in his paper; but at present the one which had come prominently before them, and was of most general application, was the question of oil gas made from petroleums. The particular conditions existent at certain works might render it more favourable working with some of the hydrocarbon residues obtained in gas-works working—the furnace oils, and so on; and that was a point which certainly deserved very much more attention than it had at present received. For the present, he had been obliged to confine his work to the one branch of the subject. Mr. Gandon had also referred to his statement that the residue was 5 per cent. of carbon. That was the fact; and he thought that, taken in conjunction with Mr. Young's statement that he obtained 25 per cent. of carbon, tended to support the results he had given, and which were confirmed by Dr. Salomonson's work—that the actual yield of oil gas apart from the oxygen from one ton of oil was larger when oxy-oil gas was made than when oil gas alone was produced. They had this point to consider, in addition to the actual enrichment of the oil gas. Professor Lewes quoted Mr. Linton's report, and showed figures which came very near at all events to, or about the same as, the results he had realized. Without wishing to throw any doubt on the results obtained by Mr. Linton, he, like Professor Lewes, was inclined to rely more on his own figures than on those of other people. As to Mr. Linton's work, he thought it was perhaps not as extended as was necessary. Mr. Sheard had put the results at a rather lower figure; and he noticed a few weeks ago in the JOURNAL OF GAS LIGHTING a paragraph from the Scotch Correspondent (who certainly generally looked on the bright side of Mr. Young's process), which ran: "The Musselburgh Gas Company have been working their new oil-gas plant for about a month; and Mr. W. Thomson, the Manager of the works, expresses entire satisfaction with the results he is getting. Adding one-seventh of oil gas raises the illuminating power of the gas supplied to the town by 5 candles; the quality of the gas sent out being 28 candles. The plant is on the Peebles process. Two retorts are used, which are heated, as in Galashiels, by the same furnace as the coal retorts." That worked out at an enrichment of 5 candles for 12½ per cent. There were two points to be borne in mind: One was that the candle power of the gas to be enriched was a high one—23 candles; and, therefore, one would expect to get a lower enrichment than with a lower candle power gas. The second point was that this, of course, was working in a gas-works not under the supervision of the patentee; and they might perhaps have to discount the result to a certain extent by the working not having been carried out under the most favourable conditions. Still, as the result of running over a month, and as the figure was given and published by the Manager as being a very favourable one indeed for the

process, he thought perhaps it deserved mention in that respect. With regard to Mr. Watson's remarks, he agreed that experiments of that kind were interesting; but he also agreed with the President when he said they required to be undertaken with great care, and there were a great many conditions to be taken into consideration before one could rely on any such statements. Mr. Watson had inferred that the decrease in volume was due to actual contraction in the mixture; but, seeing that he had been dealing with carburine vapour, it was much more probably due either to the deposition of some of the vapour, or the absorption of some of the vapour by water. In his (Dr. Thorne's) experiments, he certainly had not been able to detect any increase or decrease in the volume of gas. When he had added 5 per cent. to a certain volume of gas in the holder, he had not observed an increase or decrease; but, of course, he had not carefully carried out experiments on this point. With Mr. Helps's remarks, he warmly concurred. He had also experienced the same sort of thing that he had spoken of—the much heavier fall in common coal gas in keeping it in small holders over water than would be anticipated from the general statements of working results of gas managers; and he had also experienced a greater advantage in adding oxy-oil gas to enrich coal gas which had been allowed to lose its enrichment in the holder than freshly-made coal gas that had not been enriched. With regard to what Dr. Salomonson had said, he thought his results and the way he had tabulated them—comparing the results with oxy-oil gas and oil gas—were of great interest; and, of course, they corresponded almost exactly with the results that he (Dr. Thorne) had been able to lay before the members, but they were expressed in a different way. He was quite prepared to admit that there were many other ways of looking at the Tatham process than as the oxy-oil gas process; and he thought it was more than probable that the addition of oxygen under certain conditions ought be of advantage in several other processes. Coming now to perhaps the stronger criticism of his friend, Professor Lewes, he found it much more difficult to deal with the matter—their results being so diametrically opposed; and he did not know how they really were to explain the question. Professor Lewes said he relied on his results; he (Dr. Thorne) ventured to do the same. In his own case, the experiments had been carried on in various places, and under various conditions, both on a small scale and on a large scale; and he would admit that he had been forced from, in the first place, a sceptical turn of mind to the reverse—to a thorough belief in the process, in what the patentee claimed for the process, and in not only what he claimed, but in the value of the process as being in advance of all other systems at present on the market. The process must, of course, stand or fall by comparison with the best process. He was quite prepared to admit, with Professor Lewes, that the Young system was the one they had to look upon as the—well, let him say for the moment—competitor with the Tatham process; but he thought that very possibly even the Young process might find the Tatham process to be a friend rather than an enemy. His results certainly led him to believe, in the present state of things, that enrichment by the Tatham process was decidedly cheaper than by the Young system. He still could not quite understand Professor Lewes's statement, even after his own admission, that oxygen was detrimental to the effect of oil-gas enrichment.

Professor LEWES: I said it did not do it any good.

Dr. THORNE (continuing) said that, in the paper recently read at the meeting of the Society of Engineers, Profesor Lewes said: "Such a gas would be useless for enriching purposes, as the oxygen which, with the rich gas, perfected the burner, and so gave an increase of illuminating value, would, when the gas came to be diluted with poor coal gas, overdo the combustion, and would cause a loss rather than a gain in illuminating value." Certainly until further experimental evidence was brought forward, he should stand to his own figures. They also obtained an increased volume of oil gas produced in the process of making oxy-oil gas over other processes of making oil gas. This point was difficult to explain; but he believed it was due to the fact (and this belief was increased by the fact that they had obtained a much less percentage of coke than the Young people, for instance) that the hydrocarbons did not undergo such rapid cracking. In the Young process, they got from the oil a mixture of gas and vapours, which was very carefully washed; and this washing took out not only the vapours that would be taken out by condensation, but others which would be deposited slowly in the course of the mains, and so on. These condensed vapours were taken back into the retorts. Some were re-vaporized, and others were cracked over and over again; in each cracking losing a part of the hydrocarbon in denser forms, which did not crack so readily afterwards. In the case of the oxy-oil gas, he believed some of these less easily condensable vapours (or the substance lying between vapours and gas, because there was no line of demarcation) got carried on; and in this way they had less repeated cracking, with the decomposition of the oil, so they obtained more of the carbon and hydrogen of the oil in the form of oil gas than in ordinary gas processes. Professor Lewes had spoken of their conversation with regard to the combination or, as he called it, engagement of the oxygen and oil gas. He (Dr. Thorne) was still of the same opinion; and he believed that they had a gas which, in some way or other not well understood, exerted, as it were, some sort of solvent action. His experiments on oxy-oil gas had led him also to believe in the increased stability given to the gas by the oxygen; and this view was most strongly increased by repeated experiments carried out by himself, by those of Mr. Herring, and by the statement made by Dr. Salomonson. As to the point that the oxy-oil gas, when subjected to severe conditions, actually lost less candle power than the unenriched gas, he himself did not see how they were to explain the fact that 15-candle gas would lose 1⅓ candles if kept for a certain time under certain conditions, and when the same gas was enriched with (say) 10 per cent. of oxy-oil gas, it would lose only 0·5 candle under like conditions, except upon the assumption that the oxygen had some special and peculiar carrying or solvent power over the hydrocarbons. They had now come to a point when their experiments seemed, at the present at all events, to be diametrically opposed. Professor Lewes had said he would like to verify the experiments, and he thought that Mr. Herring would be very pleased to see him, and give him facilities for carrying out the experiments. The remainder of the plant at Huddersfield was now in forward progress; and, before long, the whole of it would be in thoroughly good working condition, when he hoped experiments would be made on a large scale. All he could say at present was that he was prepared to stand completely by the results he had put forward; and he held absolutely to the view he had already expressed, that the oxy-oil gas process was a great advance on any of the other systems at present available.

The PRESIDENT, in proposing a hearty vote of thanks to Dr. Thorne for his valuable paper, said his only disappointment with regard to it was that it did not wear a little more scientific aspect. They had had this put so strongly before them—the differences in the two methods of using oxygen, in the one case mixing it with the oil gas, and in the other making it part and parcel of the process of making the gas, that it would have been interesting to have had some specific explanation as to how these differences came about.

Mr. C. E. BOTLEY (Hastings) seconded the motion, which was agreed to.

Dr. THORNE briefly acknowledged the compliment.

This concluded the business before the meeting; and afterwards high-tea was served.

The Forthcoming Exhibition at Lyons.—Lyons, the third city of France, will next year be specially attractive from the fact that there will be held in it an important international exhibition, the buildings for which will cover an area of 50,000 square metres. Gas lighting will come under Class 25; and electric lighting, under Class 34.

Fomenting Agitation.—A significant statement is made in an apparently inspired paragraph which appears in a local paper with reference to a meeting of Preston gas workers on Friday evening last. The object of the meeting, it is said, was to promote some efficient scheme of organization among local gas workers; and a Mr. Clynes, of Oldham, described as "an organizer of gas workers," enlarged on the benefits to be derived from Trade Unionism. At the close of the meeting, several of those present consented to join the Union. The gas workers of Preston, we read, have no special grievance against their employers, but consider it advisable to be prepared for an emergency.

The Scotch and French Oil Trades.—Some time ago the French Minister of Commerce commissioned a French engineer to make a careful inspection of the Scotch and French oil-works, to ascertain how it was that an industry so precarious in France had made considerable advance in this country without the advantage of protection. The engineer in his report states that the bituminous shales in the Scotch fields are much richer in oil than those of the principal fields in France—the yield being 27 gallons of oil per ton, as against 11 gallons; while French crude oil contains only 2 to 3 per cent. of paraffin, against 12 per cent. in the case of Scotch crude oil. Moreover, Scotch shale, when distilled, provides a considerable quantity of ammonia, which, subsequently converted into sulphate, constitutes two-thirds of the value of the commercial products of the shale. This latter is urged as the reason why the industry in Scotland has not completely collapsed in the face of American competition. Of this competition, evidence is given in the fall of prices to one-half, one-third, and in some cases one-fourth of what they were twenty years ago. Improvements, it is stated, have reduced the cost of production of a gallon of oil, in the period which has since elapsed, from 12·633d. to 4·44d.; but even this is above the selling price, which is only possible in consideration of the recovery of ammonia. In regard to mining methods, the French engineer considers a comparison as entirely favourable to France; the cost of winning shale being 5s. 6d. per ton in Scotland, and 2s. 9½d. to 3s. 2½d. per ton, according to density, in France. He counsels the adoption in France of the Scotch method of using superheated steam in the rectification process, which is always advantageous in the fractional distillation of oils not very rich in illuminating properties. He approves thoroughly of the process of shale distribution for crude oil which is characteristic of the Scotch industry; and he advocates the adoption of the progressive distillation, finishing at a very high temperature. This he thinks would greatly increase the yield from French shale.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Ninety-sixth Quarterly Meeting of this Institution was held last Saturday, at the Palatine Hotel, Manchester. The chair was occupied by Mr. JAMES BRADDOCK, of Radcliffe, the Senior Vice-President, who at the outset read a letter from the President (Mr. W. R. Chester, of Nottingham), explaining that he was confined to bed by an illness which exhibited all the symptoms of *la grippe*.

THE MINUTES.

The HON. SECRETARY (Mr. S. S. Mellor, of Northwich) read the minutes of the previous meeting, held at Nottingham on Sept. 2; and they were confirmed.

ELECTION OF PRESIDENT.

Mr. JAMES PARKINSON (Brighouse) then proposed the election of Mr. Braddock to the office of President. Mr. Braddock, he said, had been a member of the Institution for some years, and had worked very hard for it. He filled the office of Secretary for a long time; and on the Committee he had been indefatigable in his efforts to promote the interests of the Institution. They had had as Presidents many very able men; and he (Mr. Parkinson) was sure Mr. Braddock would not allow the lustre of the chair to be dimmed during his occupancy of it.

Mr. T. DUXBURY (Darwen), in seconding the motion, said he had known Mr. Braddock for many years; and they all admired his quiet, unostentatious, thorough-going character. No doubt he would make as good a President as they had had for a long time; and though his works might not be so large as those of some of his predecessors in the presidency, he had a downright sterling character, and would stand second to none of the occupants of the chair.

The resolution was carried by acclamation.

Mr. BRADDOCK heartily thanked the members for the high opinion expressed of his services in the past, and the desire that he should occupy a more prominent position in the future. It was with very serious misgiving that he permitted himself to be elected to the chair. He did so, however, with absolute reliance upon the support which they had given to Presidents in the past, and which, he believed, would not be withdrawn in his case. He trusted that he might retain, at the end of his year of office, the confidence and good feeling which they had so heartily manifested towards him.

Mr. J. CHADWICK (Oldham) then read a paper on the subject of "The Stacking of Coal, and Coal-Haulage Machinery," which is given below.

A lengthy discussion followed, a report of which will appear next week.

The members afterwards had tea together.

THE STACKING OF COAL, AND COAL-HAULAGE MACHINERY.

A Paper read by Mr. J. Chadwick, of Oldham, before the Manchester District Institution of Gas Engineers, Nov. 25, 1893.

As time goes on, and members of Gas Associations continue to meet with increasing frequency, it becomes more difficult for those at the head of the various organizations to find new subjects to bring before the members for consideration, discussion, and interchange of opinions. But it is not at all times necessary that we should have new subjects to confer upon, when we meet together to compare notes. Many old subjects we may revive, and look at them (it may be) from different points of view—approach them with a wider experience, a more extended acquaintance, and possibly with our knowledge more developed. Of the many subjects which have been brought before Gas Associations at various times, and which have been carefully considered from various points of view, the "storeage of coal" has not by any means been neglected. Many gentlemen have, on different occasions, brought this subject before the various Associations with which they were connected; and it has been freely discussed. One of our own respected Past Presidents gave us a most valuable paper some time ago upon a somewhat similar subject. It is not, therefore, that I have any intention of, or am even capable of, introducing anything new on this subject that I have undertaken to bring it under your notice; but circumstances have occurred recently which caused me to think that it would not be an inopportune time to talk over this old subject once again.

It seems to me that the stacking of coal is, in future, likely to receive more consideration at the hands of large users of this commodity than has perhaps hitherto been the case. True, the importance of holding coal in readiness for cases of emergency by large consumers has not been neglected in the past; but what has been considered a sufficient quantity to hold for the temporary suspension of supply, may not be considered adequate in the future. I need not go into the question as to the quantity of coal such industries as are represented by the iron trade, or the railway companies or steam-ship companies, or the many other branches of industry which are dependent on coal amongst other things to work their various concerns, their traffic, &c., should hold. Sufficient for present purposes to confine our consideration to what most particularly concerns our own industry—viz., the gas-works of the country. I think I may safely say that it has been generally, if not universally allowed, that it was desirable (nay, even necessary) to have on our works a stock of coal at all times, to prevent serious inconvenience in case of any stoppage of supply. The quantity necessary to be held as a safeguard may have varied in the opinions of different people; and the geographical position of the particular works may have had some influence in determining what was a safe quantity to have.

The stacking of coal in most cases costs money; and the less we have need to stack, to be on the safe side, may be the most economical. A quantity equal to six weeks' maximum consumption has been generally considered sufficient to have in stock at any time; and naturally those who have adopted something like this quantity would have this stock at the commencement of the darker weather—say, in autumn. Most of us who have been fortunate enough to have so large a quantity of fuel by us at that time, have entered upon the time of heavier make of gas with complacency and composure, so far as the coal supply was concerned—thinking we should be able to meet all requirements; and generally we have been able to do so. But whether we shall consider such a quantity sufficient, or whether we shall place much reliance on our geographical position in the future, are matters which may be open to consideration and question. I am of opinion that many of us will take means to provide for storing coal in larger quantities than we have hitherto done. The stoppage of the coal supply from so large a portion of our coal-fields, and the suspension of work extending for so long a time as has been the case quite recently, may well cause us to consider the advisability of holding larger stocks at our gas-works.

Unfortunately, the relations between capital and labour in almost all our industries are such that a cessation of work may be brought about upon large or small differences of opinion or action from either side. The recent stoppage of work in the coal trade shows us, among other things, the extreme difficulty of obtaining supplies of fuel under such circumstances. Although large stocks were held by many colliery proprietors, still there was great difficulty in moving them away. It may be said (indeed, it has been said) that if there had been no large stocks, there would have been no stoppage. That might have been the case; and it is not improbable that colliery proprietors will be unable in the future to accumulate such large stocks on their pit-banks. But if the stocks are small, who shall say that a stoppage may not even then take place, or an advance in the price of coal be made to ensure the pits working. Capital insisting on a reduction of wages to labour, was the cause of the recent stoppage. The converse is just as likely to occur. Labour may insist on a greater share of proceeds than capital is disposed (or even able), for the time being, to grant, with similar results. From whatever cause the stoppage of the coal supply over a large area or for a lengthened period is brought about, besides the difficulties experienced in obtaining supplies, the result is a great advance in the price of the material. This was so in a marked degree quite recently; so much so that it is probable that many gas authorities will be obliged to advance the price of gas to their consumers, in order to recoup themselves for the extra expenditure thereon. It is hardly likely that disputes in the coal trade of such an extensive character will occur very frequently; but still disputes have occurred, and will occur, at intervals. Can we not then mitigate the evils, and lessen the difficulties somewhat when a suspension of supply does occur, by holding larger stocks of coal than we have hitherto been in the habit of doing?

The saving of labour in every branch of industry has for many years past been the aim of mechanicians, as well as of those persons connected with, and in charge of, our various factories and workshops. A large quantity of work which to-day is done quickly, efficiently, and economically by the aid of machinery, was formerly accomplished by hand labour only—necessitating an expenditure of more time and more money. No matter where we go, or where we turn in our busy hives of industry, labour-saving appliances meet us on every hand. The mechanical engineer makes special tools for various kinds of work required in his own business; the carpenter has his machines for planing, mitreing, squaring, boring, &c.; the mason has the bulk of his rough and heavy work done by machinery; the textile industry has its many improvements in machinery for expediting the work performed; the book-binder, the shoemaker, the tailor, and I might enumerate a great number of other trades whose work has been expedited and probably made more efficient and economical by the aid and use of machinery. It is not, therefore, surprising to find that the use of machinery in our gas-works is extending. It may be said that its adoption has not been so general or so quick as it ought to have been. Still for many years the adoption of machinery has been the idea and aim of many people; and trials of various kinds of apparatus for working our retorts have been made. Some have been fairly successful, and have been continued; others have shown room for improvement, and have been modified and amended. Considering that machinery for this purpose has to undergo great hardship in its use—embracing rough handling and usage, great variations in temperature, and that it has to work in an atmosphere (more or less) of dust, dirt, and smoke—I think we

must allow that the retort-stoking machinery of to-day has made considerable headway towards general favour and more extended adoption.

For the handling of coal and coke, the use of machinery is becoming a matter not only for consideration, but one that is being acted upon. The stacking of coal, for instance, may become a serious item (as to cost) in many gas-works. When thousands of tons of material have to be put into our sheds every year, it becomes not only a question as to which is the cheapest way, but many times also which is the most expeditious. Gas-works are differently situated, and exist under different conditions and circumstances in having to deal with their coal traffic. Some works have neither railway nor canal accommodation; and all their coal has to be carted into the works. Others will have railway sidings on the works. Some are in connection with canals or navigable rivers; but these will have the coal to move from the railway trucks or barges, as the case may be. The situation of the works, and the quantity of material to be dealt with, will have to be the factors which must help us to decide on the best and cheapest means of transferring the coal from the barges or trucks to the coal-stores. If the works are small, and the quantity of material consequently not very large, hand labour may still be the best and cheapest means; but when there is so much material to move that it is possible to reduce the amount paid for hand labour by what will cover the interest on the cost of machinery, together with the wear and tear thereof, so soon I think it is advisable to consider what kind of machinery will best suit the particular requirements, and to arrange and adopt accordingly.

A jib crane might be found sufficient in some cases; and it might be supplemented by the use of small tip-waggons on an elevated roadway. Conveyors might perhaps come in to be useful and efficient. Elevators and conveyors combined might still better meet particular requirements; or other means might be devised to suit the particular place to be dealt with.

I purpose giving you a description of the coal-haulage machinery I have erected at one of the works under my charge. At the works to which I refer, and which are known as the Higginshaw works, belonging to the Oldham Corporation, there is a branch railway running alongside the land; but it is some 21 feet below the level of the coal-shed. By a series of inclines, we get the coal-trucks on to the same level as the shed-floor, and alongside one end of it. Formerly, the unloading of coal cost us about 4d. per ton, by hand labour. Some four years ago, after carefully considering several methods for adapting machinery, I eventually came to the conclusion to adopt a system which would combine the breaking, elevating, and conveying of the coal, so that I might be able to deposit it in any part of the shed.

I have two sets of breakers, elevators, and conveyors, each a duplicate of the other; but they are separate and distinct, and complete in themselves, with the exception that the steam for working them is generated in one boiler. I shall describe one set of machinery, and the working thereof: A 10-horse power horizontal steam-engine running at about a hundred revolutions per minute, works the apparatus. The engine is geared to the coal-breaker by steel wheels of double purchase. The breaker is composed of two cast-steel rollers, with gripping teeth. Small coal passes between the rollers; while the teeth take hold of large lumps and break them. The elevator is fixed conveniently to take the coal from below the breaker to a sufficient elevation to carry it along the coal-store. The hoisting apparatus is made for lifting a railway truck so that its contents may be emptied into a hopper immediately over the breaker. This hopper is capable of holding about 10 tons of coal. The hoisting gear is also arranged so that it may traverse along iron girders; and it is able to take hold of a waggon at either end. The conveyor is a band-conveyor, composed of a number of thicknesses of cotton cloth stitched together lengthwise. It reaches from the top of the elevator, where there is a shoot to allow the buckets to empty themselves on to the conveyor; and the band reaches from one end of the shed to the other—a distance of some 200 feet—and travels about 190 feet per minute. A series of rollers carry the band and coal upon it; and the empty or return band is carried by another set of rollers. The band varies a little in length, according to the state of the weather and other circumstances; but an arrangement is made by which any variation can be taken up or given out as the case may be. There is also a throw-off carriage, which can be placed in any part of the shed, and which will then throw the coal off the band at that particular spot. At a convenient place, a shaft is fixed to work in bearings attached to wall brackets; and on this shaft there is a pulley which carries the main driving-belt from the engine. There are also pulleys to work the waggon hoisting and traversing gear, with open and crossed belts for working in different directions. These belts are controlled by strap-guiders, worked by chains; and are under easy control of the workmen. The elevator is worked by a sprocket-wheel fixed on this shaft, and a pitch-chain passing over another sprocket-wheel at the head of the elevator. Sprocket-wheels and chain also work the conveyor.

In working, the railway trucks are brought over the hopper; and the truck is then taken hold of by the hoisting gear, and one end lifted. The door being opened at the other end, the coal falls into the hopper, and through the breaker into the pit at the bottom. The elevator buckets are working through this pit, and scoop up the coal, and raise it to the head of the elevator, where it is thrown into the shoot, guided to the conveyor, and taken to any part of the shed required.

We have had this machine working now for more than three years; and I am pleased to say that it has worked exceedingly well.

I think that this was about one of the first installations of machinery for the specific purpose of unloading and stacking of coal; and the amount spent in repairs and maintenance up to now, has been practically *nil*. The wear and tear is not nearly so much as I anticipated. We find a monetary saving by its use; and this saving will be greater as more material is required, because the machinery is capable of doing three or four times the work we have at present for it to do.

The total expenditure on the machinery, and for alterations incidental to its erection, was £3700. The amount of money spent in wages last year for unloading 34,000 tons of coal was £330 less than the amount spent on a similar quantity of material previous to the erection of the machinery. If we reckon 3½ per cent. interest on the outlay, and 2½ per cent. for wear and tear, we have a charge of £213, which leaves us a saving of £117 per annum. But we might reckon 5 per cent. for wear and tear, which, with the charge for interest as before, would make a sum of £305—still leaving £25 to the good. But as I have already said, we have expended very little on repairs yet; and I think that the 2½ per cent. will cover everything in the shape of wear and tear that will be required. The expenditure on coal, coke, water, and oil to work the apparatus comes to about 10s. per week.

We also find it most convenient, and expeditious in its working. Most of you are aware that traffic does not always come along very regularly. In the winter months for instance, when foggy weather prevails, it often happens that traffic is detained; and then when the weather clears somewhat, a sudden inrush of waggons comes—occasionally two or three days' traffic all at once. We can deal with this without much inconvenience. We have on many occasions taken such a quantity of material in one day, with very little extra trouble.

You will notice that in the arrangement of the machinery I have been describing, the movement of the coal is all in one direction. But this can be altered, and arranged to suit any particular requirement.

Many gentlemen connected with gas-works in various parts of the country have been to see this machinery working. Some are members of this Institution, and they may perhaps give us their impressions thereon. I understand that some were so satisfied with their visit, that they are contemplating the erection of machinery of a somewhat similar character. Amongst others, I may mention the neighbouring town of Bury, where the Gas Committee, after very careful consideration, and under the recommendation of their Manager, have decided to erect, and have now in hand, an installation of coal-haulage machinery on similar lines, and for a like purpose—viz., stacking coal in their shed. I hope they will find as much benefit from its application as I have from the one I have been describing to you.

[By the kind permission of Mr. West, one of our members, I am able to show you a few drawings where this system is made to suit various requirements.]

The Plymouth Gas Company are about to erect at their works a plant by which they anticipate being able to dispense with a considerable amount of labour in transferring coal from ships to their store. The Gaslight and Coke Company also have had machinery for coal-haulage erected at their Kensal Green works, and so far as I learn with satisfactory results. This conveyor, however, is somewhat different in construction to the one I have been describing. I think therefore we may conclude that coal-haulage machinery in our gas-works is on the increase; and ere long we may hope to have other information which will help us to a more general knowledge as to the economics thereof.

Before I close my paper, I may perhaps say one or two words about the application of machinery for the haulage of coke. This also is receiving great attention at the hands of gas managers; and coke-conveying plant has already been erected at several gas-works—Birmingham, South Metropolitan, and Melbourne, being amongst the number. For moving coke, I think machinery will become more extensively used, because it not unfrequently happens that coke has to be piled up to a great height, and this becomes a matter of considerable expense. With the machinery, however, as now made, coke as it leaves the retort-house, can be taken into store to any reasonable elevation, or it can be deposited into hoppers ready for immediate delivery into carts, barges, or trucks, as the case may be. I believe our President (Mr. Chester) contemplates the erection of coke-conveying plant, with breaking and washing apparatus combined, by which means he will be able to prepare his coke to suit the special requirements of his district.

I have here a drawing showing an arrangement for coke conveying, elevating, stacking, screening, and filling into waggons or sacks. You will observe that the coke, as it is drawn from the retorts, falls on to conveyors, which carry it to a pit, about the centre of the retort-house. This is a metallic conveyor, formed of iron or steel plates; and the hot coke, on its way to the pit, is quenched with water. From the pit, it is elevated and then conveyed into the yard for storeage, or placed into hoppers or railway trucks, or conveyed into screens, which

clean and sort it to various sizes, when it may be put into sacks ready for sale.

The introduction of inclined retorts has brought coal elevators and conveyors more into use; and this system of carbonization seems to lend itself readily thereto. Many places where this system is working have some kind of coal-haulage machinery in connection therewith.

Well, gentlemen, I think you will agree with me that there are sufficient examples of machinery at work for transporting materials in our gas-works to warrant us in saying that it has got beyond the experimental stage.

AMERICAN GASLIGHT ASSOCIATION.

The Annual Meeting at Chicago.

In the JOURNAL for the 14th inst., we commenced a report of the proceedings at the above-named meeting, including the principal portion of the address delivered by the President—Mr. A. E. Boardman, of Macon (Ga.). In our last issue we gave an instalment of the paper read by Mr. F. H. Shelton, on "Gas-Engines in the United States," the concluding portion of which appears in another column to-day; and below we continue our abstract report.

At the close of the President's address, the meeting proceeded to the hearing of three papers relating to purification, of which the first was entitled "The Revivification of Iron Oxide," and was read by Mr. G. T. Thompson, of St. Louis, Mo. The author commenced by insisting on the importance of keeping accurate records of purifying operations, and of each lot of material employed. Each purifying vessel might be permanently marked with a distinguishing letter; and each lot of material, by a figure. Specimen pages of such records were exhibited. One showed the dates of changes of purifiers, meter register, gas purified, and material used. The other was for any one lot of material, and was headed with a description, after which came the number of days in purifier, and quantity of gas purified, &c. He next remarked that, however necessary the use of lime as well as oxide might be in England, it was not so in America, "where, with the absence of hampering sulphur clauses and a less cost for enricher" many engineers found that oxide alone was sufficient. After briefly touching upon the historical part of the subject of revivification, he referred to some results obtained by Mr. Irwin Butterworth, at Columbus, by the adoption of Mr. Dexter's suggestion to use exhaust steam in connection with revivification *in situ*. In the course of four months, 63 million cubic feet of gas were purified with only three changes; whereas during the corresponding months the previous year, twenty-one changes were necessary to purify 56 million cubic feet. He had tried the process at his own works during the past summer, with extremely satisfactory results. He had also tried the revivification of oxide in an off-box, with the cover in place, by forcing air through it; and he found by analysis that the air was almost completely deoxidized. But there was difficulty, on account of the hardening of the oxide; and in order to overcome this, he had tried aspirating the air downward by a steam-jet, as recommended by Mr. W. A. Wood before the New England Association of Gas Managers, but introducing the jet at the inlet-elbow and causing it to point upward. In this case, the air was aspirated through the material from the top, and also caused to ascend through it again. About three out of every four boxes opened could be treated in this way during the ten months that the process had been tried; but it was found that either very fresh or very old oxide was apt to fire. It rarely paid to saturate oxide with more than 48 per cent. of sulphur; and each lot should be examined at intervals for percentage of sulphur. Although there was an outlet for spent oxide in England, there seemed to be none in America—probably on account of the cheapness of native pyrites; and the only way of turning it to account was to burn it, by which means the oxide would be recovered in the anhydrous state. This, however, was attended with difficulty, as a large excess of air was necessary, and the sulphur was apt to fuse. As a means of preventing the heating of new oxide, the author preferred careful attention, and immediate removal from the foul box, to the plan of mixing a portion of partially spent material with it.

Mr. J. A. P. Crisfield, of Savannah, Ga., followed with a paper on "The Rate of Purification," which consisted of an account of some experiments entered upon with a view of determining how much weight should be given to each of the mutually dependent elements capital and labour, so that their combined cost for interest and wages might be a minimum. He used iron sponge, containing 15 per cent. free sulphur, and weighing 60 lbs. per cubic foot; and 28-candle carburetted water gas was passed at various rates. By actual trial, it was found that the area available for the passage of gas was about one-third of the total volume of oxide, from which the rule was deduced—

$$\text{Time of contact} = \frac{\text{volume of oxide}}{3\ (\text{quantity of gas})}$$

Applying this rule, it was found that the duty per cubic foot of oxide ranged from nothing with a contact-time of 32 seconds, up to 24,000, at 96 seconds; a duty of 16,000, however, being attainable with 48 seconds, which was, all things considered, the most advantageous period. Throughout the three months that the experiment lasted, it was found that the cost for labour averaged 1d. per cubic foot of material handled; and he had taken interest on capital at 10 per cent. As a rule, for the most economical size of box, he gave the following: Volume of oxide = $\frac{1}{30}$ (gas passed per hour). The smaller the number of boxes used, the better the results; and the author expected to see purifying apparatus reduced to one box, instead of four, as at present.

The third paper, entitled "Temperature in Relation to Purification," was read by Mr. James Somerville, of Indianapolis, who had found that at a certain temperature both oxide and lime failed to purify the gas. At 32° Fahr. unpurified gas was passed, as evidenced by the usual signs of bad odour and loss of illuminating power; but a singular thing which had caused much confusion, was that at this low temperature the ordinary test-papers were not affected, and the gas appeared clean. In raising the temperature, the trouble disappeared. Water gas treated with oxide of iron only, gave the same results. On account of these observations, he had taken analyses of gas passed through lime and oxide respectively at varying temperatures, ranging from 108° to 32° Fahr. Samples of 17-candle coal gas and 19-candle water gas were taken from the purifier-inlet, and passed through a small experimental purifier; and the purification was efficient, except in the case of water gas at 32° Fahr. The gas purified at high temperatures was largely charged with water vapour; and the illuminating constituents of the water gas were slightly reduced at the low temperature. The author recommended that the temperature of the purifiers should not be allowed to fall below 60° Fahr.

A discussion on the above three papers was then taken. Mr. Littlehales understood Mr. Thompson to say that lime could be entirely dispensed with, in favour of oxide purification; but the analyses quoted by Mr. Somerville appeared to entirely disprove that position. They showed that without lime from 2 to 4 per cent. of carbonic acid remained in the gas; and it was generally admitted that each unit per cent. of carbonic acid reduced the illuminating value to the extent of 7 per cent. Oxide of iron would not take up any carbonic acid; and its removal could not be effected to any great extent without lime. Therefore, even if the enricher used in order to compensate for the carbonic acid was cheap, the result would be a heavy gas. The lime and oxide should be used separately. Little advantage was gained mixing the two together, because the lime soon became carbonated, and then had no further effect, but was a useless adulterant. Using lime first and oxide after, with large purifiers and efficient washing and scrubbing, his cost for purifying during the last five years had not exceeded 0·1d. per 1000 cubic feet. He never changed more than six purifiers a year; and he used nothing but natural oxide. The liability to fire was an evidence of chemical activity, and therefore of excellent quality. Mr. Somerville thought it was a misnomer to call gas containing 3 per cent. of carbonic acid a purified gas, or to talk of "complete purification" by oxide of iron. He would not like the idea to get abroad that gas managers sent carbonic acid into people's houses. Mr. Miller challenged the statement that 1 per cent. of carbonic acid affected the illuminating power to as great an extent as 7 per cent. Experiments had been brought before the Association showing that this was not the case, especially with high-power gases. Mr. A. C. Humphreys observed that the old tables showed 6 per cent. impairment for the first unit per cent. of carbonic acid. That might be so with old-fashioned 12 to 14 candle coal gas; but it was absolutely incorrect with high-power gas, so that those old rules required correction by later experiments.

Mr. Thompson, in replying, said he had stated that lime could be dispensed with to advantage where cheap enrichers could be had. He did not follow the contention that carbonic acid was hurtful in other ways. Such a quantity of carbonic acid was produced when the gas was burned, as to render the presence of 2 or 3 per cent. in the gas of no consequence. He was glad Mr. Somerville agreed with the importance of maintaining high temperatures in the purifying boxes. This was secured by using steam, which not only supplied moisture, but added to the heat of the boxes.

Mr. F. B. Wheeler, of Mount Vernon, N.Y., read a paper on "Mathematical Analysis applied to Photometrical Observations in Legal Cases," showing the method by which he examined sets of twelve daily photometrical tests, taken by a gas manager and by an expert appointed by the public officials respectively, with a view of arriving at the correct result. The city examiner's average was 19·72, and the gas manager's 20·76 candles; and he decided to analyze the figures by the method of least squares. The square of the difference between each result and the average of the whole was taken; and the sum of the squares was 16·35 in the examiner's and 2·5 in the gas engineer's figures. From this it was concluded, by the theory of probabilities, that the value of the tests as measures of precision was in inverse proportion, which gives 6·6 to 1 in favour of the latter. The most probable value of the gas was obtained by multiplying each average result by the opposite sum of the squares as above given, adding them together, and dividing by the two values thus—

$$\frac{(2{\cdot}5 \times 19{\cdot}72) + (16{\cdot}35 \times 20{\cdot}76)}{2{\cdot}5 + 16{\cdot}35} = 20{\cdot}62 \text{ candles.}$$

Referring to the gas engineer's average, the probable mean error would be—

$$0{\cdot}6745\sqrt{\frac{2{\cdot}5}{N-1}} = \pm 0{\cdot}092$$

where N equals the number of observations. In this case, the city contended that the gas was not up to 20-candle power, while the company claimed that it was; and his investigations showed that the latter were correct.

(*To be continued.*)

GAS-ENGINES IN THE UNITED STATES.

A Paper read by Mr. F. H. Shelton before the American Gaslight Association at Chicago, October, 1893.

(*Concluded from p.* 939.)

(3) *Is the trouble with the makers?* I am only stating facts in saying that the great majority of gas managers, including some of the most conservative and thoughtful men in the business, feel that the fault does lie in what is considered to be an illiberal policy of the leading gas-engine people. (Whether the skirts of the gas men themselves are clear, I will take up later.) It is felt that gas-engine prices are enormous. To the general question as to why more engines are not in use, "high first cost" was the reply in 50 per cent. of the answers; and to a more specific question, 94 per cent. replied that the excessive cost was largely, and often the only reason, preventing much greater use. There is almost universal accord of belief upon this point.

Of course, there are two sides to every question. The engine makers point out that, horse power for horse power, you cannot expect to buy a gas-engine as cheaply as a steam-engine, for the reason that, from the nature of the working fluid, and that practically gas-engines are but single-acting, it takes a larger cylinder and heavier engine to attain a given power. For instance, a 25-horse power steam-engine will weigh perhaps 3500 to 4000 lbs.; a 25-horse power gas-engine will weigh nearer 6000 lbs., or one-third more. In smaller sizes, the difference is even greater. Hence, if the cost per pound for making the engines is the same, we may naturally expect to have to pay the maker from one-third to one-half more per horse power if we choose to use a gas-engine. But they go further, and say that superior work is needed in the gas-engine to that which is requisite in the steam-engine. They point out that the moving parts are required to be gas-tight under 200 lbs. pressure or more; that they are subjected sometimes to heat and destroying action which the steam-engine is not; that the explosive nature of the impulse is harder than the more gradual impulse of steam; that with the high temperature there is difficulty of lubrication, requiring special appliances; that nicety of adjustment and precision of action are requisite; and that, in brief, a better quality of work is demanded than is put in a steam-engine. The makers state that the proper erection and testing of each engine costs as much as the tool work alone. This is all of interest. It is, no doubt, to a certain degree correct; but personally I do not think it is an adequate explanation. No one questions the workmanship or the operation of, for instance, the "Otto" gas-engine. It is a beautifully-built, smooth-running piece of machinery. But so are the better-class steam-engines. One can get good, bad, and indifferent in either gas or steam; but comparing the better ones, I do not believe better work is or should be needed in gas-engines than should be put in steam-engines. If I am wrong, and better work is needed, then I say it is high time the designs were changed to a cheaper form of construction that will effect the same work. That this is the tendency is shown by the "Otto" people in discarding the slide-valve (expensive to make, and so delicate in adjustment that a duplicate is part of the outfit of each engine) for the simpler and cheaper poppet valves. In some other engines it is aimed to make one combined valve do all the work; thus simplifying and reducing the cost. Of course, here frequently efficiency is lost. New charges become diluted with air or the burnt products of combustion. The very highest economy undoubtedly calls for the nicest design. But my point is that, as a rule, complexity of detail and a design involving high cost, is a great fault in many gas-engines.

Let us see what the relative costs really are. I take an "Otto" as a typical high-class standard gas-engine. Freely admitting its excellence of make and its degree of standardness, so to speak, may console slightly the makers for the unfavourable conclusion I draw. A 5-horse power sells in the neighbourhood of $450, while a 5-horse power steam-engine can be bought, of excellent make, for $150. A 25-horse power "Otto" costs perhaps $1250; a steam-engine of similar power, $400 to $500. Leaving out extras that apply more or less to both, it is evident that the gas-engine costs at least from two to two-and-a-half or three times the cost of the steam-engine—often more than sufficient also to cover the boiler, &c. Granting the claims that the cost per horse power may be one-third or one-half more, owing to the size of the engine, and that a somewhat better grade of work may perhaps be needed, I submit that these do not account for the great disparity indicated above. It is natural to get all that one can for one's wares—I do not blame the makers for that; but as long as such disparities exist, the makers cannot lay the blame solely on the gas men for the small use of gas-engines, nor wonder at the current belief of an undue margin of profit. The gas men do not gainsay a reasonable profit; but the general feeling is that the matter will have to be adjusted somehow, so as to enable the sale of gas-engines at one-fourth, one-third, or one-half less than at present, or to more nearly compare with the cost of a steam plant, if a more extended use is looked for.

There are now a great many other engines on the market and springing up; but few have yet attained prominence. Some strike for the same prices as of old, while others are selling for less; and I believe their influence will be felt. I have no preferences or prejudices among gas-engine makers. For the sake of the gas sellers, and the gas men at large, I hope that, through the agency of these new engines, prices will be very much reduced; believing that all interests will ultimately be the gainers. The gas men can encourage this by looking up advertising, and assisting those engines that do sell at lower figures, provided, of course, that there are still given reasonably good work and design. In the matter of time payments *versus* spot cash, repairs, promptness of shipment, the carrying of local stocks, and kindred points, often complained of, many think the makers could profit by a comparison with the methods and results shown by those handling electric motors.

In design, also, there is room for improvement. Sometimes the noise of the exhaust is vexatious. In such cases, it can be cured by interposing a sufficient exhaust-port, or a pit, with muffling grilles. But these are additional to the cost. With a design discharging at atmospheric pressure, like the Atkinson, the trouble is removed. Again, the question of starting is still a nuisance in large sizes. To use a small motor solely to start a larger one is surely a primeval arrangement. Self-starters are growing into use. They ought to be reliable, safe, and part of the design of all but the smallest sizes, to ensure easy starting, and for ever do away with this complaint. Will anyone say, moreover, that the gas-engine will always be single acting? The Griffin is double acting; and in certain ways it is a step forward. Does it not seem that the next great advance in gas-engines that will bring them much more on a parity with steam, as to weight, size, and regularity of action, will be the attaining of double action as the rule, instead of being the exception, by overcoming the difficulties so far existing?

The gas-engine practice in America has been that of copy. The "Otto" cycle and old lines have been adopted, hashed, and re-hashed into a score of forms; but, excepting in mechanical details and arrangement, there has been scarcely any invention that can be pointed to worthy to be truly styled an American development of the gas-engine. Among gas men there is little real knowledge of the subject; and among the makers there is but little real technical engineering development. This is, of course, more a passive than an active fault. There is room for such invention and progress, however. It is within the makers' province; and, with the increased number of them, I am in strong hopes of seeing it attained.

(4) *Is the trouble with the gas men?* To be honest, I think that, while it has largely been with the makers, a good round portion of it can be put upon the gas men. Prices have been high; it has been hard to push engines; and there have been many difficulties to contend with. But, as a whole, I think the average gas man has said to himself: "Oh, well, I can't do anything with them," and has lazily laid them unduly aside from his thoughts. Suppose prices of the best make are high; there are twenty other forms to-day on the market. But the average gas man can scarcely mention even five by name, much less know that some are cheaper than others. In other words, he is not really posted. I think, too, we have somewhat lazily said, "Oh, well, the electric motor will get that;" and we have given up the fight prematurely. Some, again, say: "We have no factories; our town is residential." Have such towns no elevators, no printers, confectioners, or ice cream freezers, no laundries, or any of the other semi-domestic power purposes existing in every town, that can be developed by the seeking? Natural gas, the lower cost of the electric motor, perhaps, and other reasons are unquestionably real ones in many cases for the non-use of illuminating gas or of gas-engines for power; but, to me, many general reasons given of "not popular," "no field," "ignorance of merits," &c., were hardly sufficient. Some, more frank, admitted "want of push." One man—honest beyond his compeers—answered: "No, I am ashamed to say we do not push them beyond a general recommendation; and I can give no good reason why we do not." A "general recommendation" will not suffice. We must especially post ourselves and push them. With such an effort we can create a field, can dispel ignorance, can make them popular by persistence, precisely as a gas-stove business is built up. At the beginning, it may be necessary to put in much hard work, to give free piping, forego commissions, &c.; but every engine located means a substantial use of gas per annum. Every 4-horse power engine running regularly means one-third of a million cubic feet of gas a year. Is this not worth striving for—not only to get one engine in, but a really good number in use? I do not mean to be unduly or improperly severe in my remarks. It may be that our energies, which are apt to be fully spent in some way, have yielded better returns in other directions. But I cannot get away from the essential text of this paper—viz., that only one or two per cent. of our output goes to gas-engines. Does this seem right, and can it not be bettered?

Let us consider, for the sake of example, our own use of gas-engines. As scarcely one gas-works in fifty uses them, I asked: "Why do you not use gas-engines for driving exhausters or doing other work?" Of some fifty replies, some argued: Steam plant is already in; and we must have steam anyway. We use for fuel breeze that is otherwise valueless; hence steam power is cheaper." Others gave the variation in the speed of the exhauster and the difficulty of regulation as an objection; and others said that, even if this were satisfactorily provided for, they probably would not use gas in any event. A few thought that gas power was more liable to derangement under a stoker's oversight, and that steam was more reliable; and one considered that the steam-engine plant was cheaper. Now, I am perfectly willing to admit the force of the above arguments as reasons of due and considerable weight; but, to my mind, they are neither unanswerable nor sufficient. The gas man, as a talker on the abstract beauties of gas-engines, is letter perfect. For consistency's sake, for policy, for the sake of example, and often for absolute economy, I hold that he ought to have a motor running at his own works, as a sample. I will even go further, and say that, even if it involves a small loss in operating expense, I think the company would gain in the end. Many gas superintendents are frank in this matter. Several wrote that their non-use of a gas-engine was pure conservatism; but many said that if regulation were perfected they would probably use gas, while others said regulation had no terrors for them. Thirteen years ago, the matter of regulation was suggested in our meetings; and to-day we are no further advanced. On this point we certainly are lacking. Water-wheels, engines, motors, mechanisms of hundreds of forms, have governors all sufficient. Must we confess that we cannot design a governor to handle merely a varying speed of the load to a driving power constant or adjustable as we please? Why it should be essentially more difficult than with regulating steam power, I fail to see. In some few isolated instances, exhausters are driven by gas; but it is distinctly exceptional.

Besides exhausters in the larger works, there is certainly room for the use of a gas-engine, even if it be granted that "steam is needed anyway." Here are some of the other power uses about a gas-works: Operating a coal-conveyor, a coke-conveyor, or an oxide-conveyor; driving rotary scrubbers, fans or blowers, or power pumps for water, oil, tar, or ammonia; operating elevators, coke-crushers, shop machinery, pipe threaders, drills, &c. Is it not worth while to instal a gas-engine for at least one of these purposes, for example's sake?

Another direction in which I think the gas man is at fault is in not being posted as to the various makes and prices of engines, so as to be able to talk intelligently, and right to the point, with an inquiring customer. How is it now? A man inquires; the gas company estimate, fiddle over what form of engine is best, finally conclude to recommend a prominent one, and offer to write and get prices. The intention is good, but the method weak. Meantime the customer is button-holed by an electric hustler, with figures at his finger-tips; and when the gas man seeks the inquirer, after a week or two of time lost in correspondence and keeping it on his desk, the trade is lost. There are now at least twenty active makers of engines on the market, most of them good. Why should we not keep a file of up-to-date cuts, circulars, and bottom prices, to talk business from? If an expensive make is too high-priced, a cheaper form may often fill the bill.

Another point: Promptness of shipment and repairs. One man said: "If a customer wants electric motors, there are two or three local concerns probably able to supply him, and at once. They are carried locally in stock. If he orders a gas-engine, he's lucky to get it in six weeks." This is putting it somewhat strongly, perhaps; but the underlying part truth, at least, will be recognized by most of us. I cannot suggest the exact remedy. It must be by better co-operation between the local gas companies and the engine makers; and it partially rests on the gas men to insist upon and to bring this about. As to repairs. In any good-sized place it would well repay a gas company to educate their outside man into understanding and looking after gas-engines as much as stoves or patent burners. It is done for these latter, why not for gas-engines? Then if anything gets out of gear, in nine times out of ten it could, with his intelligent direction, be at once fixed on the spot, or repaired by a local machinist, at moderate cost, without involving sending to the maker, and consequent irritating delay and loss of time to the engine owner.

The engine makers claim that the non-use of gas-engines is largely due to the gas men keeping up the price of gas, so that it costs too much to operate them on any but intermittently working powers. That is, they argue for special day or power rate. I am not going to argue here the old question of rates, but will simply say that, while I do not see wherein the gas men could cut to the extent asked, I do think that more could be done in this direction than has been accomplished, and to the gas companies' advantage. Certain it is that gas-engines are day consumers, are constant consumers, and are good-sized consumers; and to me it would seem worth while to allow a special rate, provided its reason and method may properly and consistently be made to appear to the general public. Of course, therein lies the danger.

The question may be asked, Of what use to gas men are gas-engines worked with gasoline? I answer, As educators. Every such motor installed shows somebody what can be done; and some of those who see it will at some time be upon the market for power, and possible customers for gas-engines. I believe that gas men ought to encourage portable gasoline motors, gasoline launches, pumping-engines in country houses, &c. Mains do not reach such cases. We could not get the business now; but commercial compressed "gas in packages" may come at some time, and meanwhile all these small motors, practically gas-engines working on gasoline, educate the public, and make it easier for the gas company to instal gas-engines when there comes a chance along their mains.

So it is for gas-engines for electric work, driven not by illuminating but by producer gas. On the general question of gas-engines for electric plants I can barely touch. Opinions vary widely, although thousands of horse power are so used. Some answer "Yes;" others, "No;" most, that they would not say off-hand. It is a question of condition, undoubtedly. Personally, I incline towards them—certainly for the smaller plants. I believe that the service can be made all right by a proper design of plant—that the gas power, at least when combined with our gas plants, is in many cases the very best possible. And with producer gas, every one of us ought to know, and to advertise the fact, that through the gas-engine the highest absolute efficiency of any form of artificial power, so to speak, has been attained. That is, the best compound condensing steam-engines consume 1½ lbs. of coal per horse power per hour. This is "gilt-edged" work. Those working with between 2 and 3 lbs. are generally amply satisfied. This is on big plants. Many run at 6 and 7 lbs.; but most small plants, of 20-horse power and under, average in ordinary working conditions (not tests) 11 lbs. But gas-engines with producer gas, even of moderate size (and having to use it in the ratio of 4:1 as to quantity, compared with illuminating gas) without great effort will run from 1 to 1¼ lbs. only; averaging twice the efficiency of the best steam plants. The "Otto" people stand ready to guarantee 1¼ lbs. Bear in mind that this is on producer gas. "The high (relative) price of ordinary illuminating gas, makes the unit of heat from gas more expensive than that from coal; hence for large powers the gas-engine using ordinary illuminating gas cannot compete with the large steam-engine using coal." In small engines we now have relative economy from a summary of all the factors, using illuminating gas; but, for the larger plants, producer gas must be used to secure it, which lessens our direct interest as gas sellers. With a cheap producer fuel, however, and engines of 100-horse power, coupled in series, or the larger sizes as made abroad, I do not see why, in a great many cases, the most perfect power for dynamos is not so to be attained. I should certainly consider the matter at great length before deciding against this, were I installing a plant. My argument here is that engines driven by producer gas educate, and hence are worthy of the gas man's influence. The small manufacturer to whom we point them out is the more ready to instal a small engine to use our gas when he comes into the market, and is on our mains.

A direction wherein I think there is a large field yet to come for selling gas through engines is that of street car propulsion. Messrs. Connelly tell me that their motor is now in about the shape they want it, and that they expect it shortly to become more generally known; and, further—the important point—that while they have heretofore been working with gasoline and on Pintsch gas, the later tendency has been towards the use of city gas, using merely a compressor at the car station. Here is where the gas and the car people can unite to mutual gain. The car people do not want to manufacture gas or run a gas-works; and the gas people do want to sell their product. They want just such customers and just such advertisers of gas power as numerous cars, running most of the hours of the 24, would become. Hence there ought not to be great difficulty in coming together on a mutual commercial basis. Electric lighting and electric car lines lie naturally together, and are often operated by the same concern. Are they any more naturally allied than such a gas union would be, indicated above?

The gas-hammer is first cousin to a gas-engine; the motive action is essentially similar. In England, I believe, they are somewhat used. In America I know of none as yet. May we not look to it also, before long, as another gas-consuming piston device, that it will add to the sales in the larger cities where iron-working shops exist.

To sum up, as far back as 1878, Mr. Charles H. Nettleton, in a paper read before this Association, pointed out (and he was, I believe, the first to do so to the Association) the possibilities of the gas-engine. Within a year or so after the practical introduction of it into the United States, he had two or three installed in his town. It is unnecessary to repeat here arguments and facts that we know full well, and that are now almost platitudes. Suffice it to say that the doctrine he then enunciated is as true to-day as it was then. It is true that, owing chiefly to electric motors, it is now harder to instal gas-engines than formerly. But is it more so than in other points involving work in the gas business? Are not conditions throughout more difficult to meet than those of a dozen or fifteen years ago? Competition is keener; but we are still "keeping right along." And with gas-engines I believe that we can "keep right along."

In regard to the four points I have discussed, I believe: (1) That gas-engines, as engines, are all right. (2) That compared with other motors they are equally good, and that they can hold

their own, if properly pushed and sold. (3) That while in the past the fault has largely been due to the prices of engines, this will be bettered in the near future, through the newer makes appearing. (4) That the gas man has been at fault, and that part of the betterment of condition must come from his greater push of engines than heretofore. If this paper helps in any degree towards putting gas-engines into the position I believe they should hold, I shall feel well repaid for its preparation.

[Accompanying the paper was a long appendix, giving particulars as to the gas-engines now on the American market.]

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Need for a Technical Index.

SIR,—Mr. Cleland's remarks on this subject, in the last number of the JOURNAL, are timely; and his criticisms on the Institute's slight attempt are not perhaps uncalled for. I write, however, to ask if it be not possible—seeing the need for a worthy index is confessed—to devise, through the agency and on the initiation of The Gas Institute, some scheme for combining and utilizing, in the preparation of such an index, the many more or less valuable, if imperfect, endeavours in this direction which have been, and admittedly are, being made by individuals. The labour entailed in compiling a really useful and fairly comprehensive index to current technical literature, is only known to those who have attempted it; and, when all is done, the best result to be expected from individual effort must be very imperfect. But if those labours, which are now comparatively fruitlessly spent in isolated individual attempts to supply the want, were combined and utilized in carrying out a well-prepared scheme of classification and digest, an invaluable and a much-needed work of reference (an index and something more) might be evolved.

Nov. 23, 1893. JOHN T. SHEARD.

The Proposed Reform of Company Law.

SIR,—In your notice of my proposals on this subject in the last number of the JOURNAL, you say that the programme does not lack boldness of suggestion, but "there are many questions actually springing up in connection with the floating and administration of joint-stock enterprises which it does not touch." Perhaps you will allow me to answer this criticism in the same words as I answered a similar objection taken by the *Financial News*—viz.: "I have not propounded the text of a new Act of Parliament. The first act of a person about to build a house is to prepare a building plan. It was this plan—so conspicuously absent in other proposals of a similar character—that I submitted to the public through your columns. I did not, for instance, overlook a provision against going to allotment with insufficient capital. This, with numerous other necessary precautions, will be dealt with when the house comes to be built; that is to say, in the statutory prospectus and Articles of Association."

Winchester House, E.C., Nov. 25, 1893. J. A. KELMAN.

Projected Extension of the Barnsley Corporation Water Supply.—The Barnsley Corporation are taking measures to prevent a recurrence of the scarcity of water which has been experienced in the district recently. They are proposing to extend the water-works at Ingbirchworth; to purchase the Penistone Water-Works; and to obtain powers for supplying Ardsley, Monk Bretton, Worsborough, the Barnsley Rural Sanitary district, the several townships in Hemsworth Union, and Cawthorne, Oxspring, and Thurgoland. The Council have been in communication with the authorities of some of the townships; and it is believed that a satisfactory understanding has been arrived at. An expenditure of about £200,000 is contemplated.

The Oil-Gas Enrichment Company, Limited.—The statutory general meeting of this Company was held at the offices, in Edinburgh, on Monday last week. In the absence of the Chairman (Mr. W. Thorburn, M.P.), the Deputy-Chairman (Mr. J. Milne) presided. In view of the fact that the Company has only been in existence for four months, no formal report was submitted by the Directors. The Deputy-Chairman, however, stated that the Young and Bell, or "Peebles," process for enriching gas from oil, which had been acquired by the Company, was now in operation at the gas-works at Galashiels, Perth, St. Helens (Lancs.), Musselburgh, Dalkeith, Kelso, Peebles, Innerleithen, Alloa, Alva, and other towns, and that negotiations were at present pending with other important companies. The results obtained, according to the reports which had come to hand, were entirely satisfactory, both as regards the quality of the gas produced and the cost of production. The proceedings closed with a vote of thanks to the Chairman.

Bahia Gas Company, Limited.—In the report of Directors of this Company, to be presented at the half-yearly general meeting on Thursday, it is stated that the revenue account for the six months ending June 30 last shows a profit of £6649, which the Directors consider very satisfactory, seeing that the loss on exchange reaches the large total of £5235. The amount brought forward, added to the profit for the six months, gives a balance of £10,965. Out of this the Directors recommend the usual dividends on the preference shares (less income-tax), and a dividend at the rate of 8 per cent. per annum (free of income-tax) on the ordinary shares. These payments will absorb £6241; and the balance carried forward will be £4740. The Directors have nothing satisfactory to report in reference to the concession after Feb. 9, 1894, when the arrangement made in February last comes to an end. The Company's Manager has opened communication with the Governor of the State, offering to continue the service after that date on certain terms; but up to the present without result.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Thursday, Nov. 23.

(*Before Mr. Justice* ROMER.)

Stretton's Derby Brewery Company, Limited v. Mayor and Corporation of Derby.

To-day judgment was delivered in this case, which was before the Court at the close of the past, and the beginning of the present month (see *ante*, p. 852).

His LORDSHIP said the circumstances which gave rise to the proceedings were as follows: Many years ago, in the exercise of their statutory duty, the defendants provided a system of drainage for their district; and, as part of it, they made the sewer which passed under the road in which the plaintiffs' brewery was situate. The brewery was erected some years after the sewer was made—one part in 1869, and others in 1876, 1880, and 1881. As the different portions were erected, the owners for the time being exercised their statutory right, and drained them into the sewer by communications which had to be, and were, first approved of by the defendants. These communications respectively ran to the sewer from the floors of the cellars, which floors were slightly above the level of the sewer, so that the cellars could not be flooded from the sewer until it was filled, and pressure put upon them. In June, 1891, May, 1892, and June, 1892, heavy storms occurred, with the result that the cellars were flooded. The defendants not admitting liability, the action was brought for an injunction and damages. In considering the question of liability, it was material to decide some questions of fact. In the first place, he found that the defendants, in making the existing system of drainage, exercised due care, and were not guilty of any negligence. The system as constructed reasonably provided for the district, and for the then probable increase of buildings which would have to drain into it. In the next place, he found that, when the communications between the brewery and the sewer were made, and for some years afterwards, the sewer was well constructed, and sufficient for the purpose of draining the district. The floodings arose, not from any want of repair to the sewers, but from the large increase in the number of buildings during the last few years, so that the sewer was now of insufficient size in the event of a heavy rainfall. Assuming that it had become the duty of the defendants, as the Sanitary Authority, to construct a new system of drainage, he had to consider whether they were guilty of negligence at the time the action was commenced, or of want of reasonable care and diligence, having regard to the requirements of the district, in not providing a new system of drainage. On this point he found in favour of the defendants. Devising a new system of drainage was a somewhat difficult matter, requiring careful inquiry and the advice of experts, which necessarily occupied considerable time. For the plaintiffs it was argued that, as the sewer was made by, and belonged to the defendants, the latter were liable, in the first place, for the nuisance caused, whether or not they were guilty of negligence, and that they were not protected by the provisions of the Public Health Act; and, secondly, because they had infringed the provisions of section 19 of the Act, which enacted that every local authority should cause the sewers belonging to them to be constructed and kept so as not to be a nuisance. As he had found that the defendants had not been guilty of negligence, they could not be liable under that section. There being no legal wrong-doing by the defendants, the plaintiffs were not entitled to the relief claimed; and therefore the action must be dismissed with costs.

Saturday, Nov. 25.

(*Before Mr. Justice* NORTH.)

Lucas v. The London Water-Meter Company.

This case, which came before the Court on a motion for judgment in default of defence, was an action brought by Mr. F. W. Lucas, suing on behalf of himself and all other the holders of debentures of the London Water-Meter Company, for the realization of his security. Mr. Justice Kennedy, sitting as Vacation Judge, had appointed a Manager of the Company's business. By the debentures, which became due and payable on Dec. 1, 1891, the Company charged all its property, including any capital for the time being uncalled.

His LORDSHIP made the usual order, and directed that the Manager was not to continue to act for more than four months without the permission of the Judge in Chambers.

CONSETT PETTY SESSIONS.—Monday, Nov. 20.

(*Before Mr.* J. ANNANDALE, *Chairman, and Mr.* F. PRIESTMAN.)

Liability for the Breakage of a Lamp-Pillar.

Andrew Moralee was charged by the Shotley Bridge and Consett District Gas Company with the breakage of a lamp-pillar, caused by a runaway horse and cart, and with doing damage to the amount of £1 12s. 6d. The defendant admitted the facts, but denied his liability on the ground that he had no control over the horse and cart when the pillar was broken.

Mr. BOOTH, Solicitor, who appeared for the Company, stated that the action was brought under section 20 of the Gas-Works Clauses Act, 1847, which provided that "every person who shall carelessly or accidentally break, throw down, or damage any pipe, pillar, or lamp belonging to the undertakers, or under their control," shall pay for the damage such sum not exceeding £5 as any two Justices shall think reasonable. He did not allege any carelessness against the defendant. The horse had broken away from the driver, and had run against the lamp; but if the damage was the result of an accident, the section made the person liable for accidental damage.

Defendant stated that he was coming out of the stable yard, and just outside the gateway another cart, passing at the time, startled his horse. He was by its side, and held on to the reins, and did his best to restrain the animal. He was pulled down, and the horse got away from him, ran on to the footpath, and broke the lamp. The horse then parted from the shafts, and ran a mile before it was stopped. It was much injured, and had been off work six weeks; and he considered that he should have damages against the Company for his horse.

The BENCH looked carefully over the sections, conferred with the Clerk (Mr. Grainger), and asked Mr. Booth what his answer would be to this point: The man did his best to restrain the horse, but it got away from him; and as the lamp was not broken while he had control of the horse, he was not the person who broke the lamp. They thought the words "careless" or "accidental" might imply an accident which occurred somehow or other in connection with carelessness, not one which was beyond human control.

Mr. BOOTH said one could not conceive of an accident for damages being charged against a horse and cart, nor of the liability falling upon any other person than the driver. If this were not so, the section was powerless. It was an important case for the Company, as they had several breakages of the kind every year.

The CLERK argued that if the Company brought an action in the County Court for the accident, they would have to prove that it arose through carelessness or unskilful management; and the section cited appeared to be on similar lines.

Mr. BOOTH said he could not bring an action in the County Court under the section, as it had different bearings. The previous section (19) provided for wilful damage; then section 20, the wording of which he specially emphasized, provided for either careless or accidental breakage. Whichever way the damage was caused, the liability was the same.

The CLERK: Do you think that, for an accident under the section, a person is liable where no contributory negligence is proved?

Mr. BOOTH: Clearly so.

The BENCH asked whether, in the circumstances, the Company would be willing to modify their claim.

Mr. BOOTH said the Company did not press for the full amount; and he would accept 10s. They simply wished to establish the fact that they had a redress in these cases, which would induce people to be more careful to avoid the breakage of lamps.

The BENCH found the defendant liable for 10s., and 7s. costs.

The Halifax Corporation and Local and Outside Contractors.—The question of the placing of the retort contract with an outside firm, which the Halifax Town Council lately referred back to the Gas Committee (see *ante*, p. 772), came before that body for consideration on the 1st inst., when they decided to confirm their previous resolution. This has drawn from the Halifax retort makers a further protest, which they have addressed to the Gas Committee.

The Electric Lighting of Chelmsford.—Messrs. Crompton and Co., Limited, have lately expressed to the Chelmsford Town Council their willingness to renew their contract for the electric lighting of the town on the old terms. [As we understand these involve a loss, inasmuch as the charge per unit is much less than the actual cost of the current, our remark, when commenting upon the Company's affairs a few months ago, that this lighting was undertaken merely as an advertisement, seems to have been fully justified.

Electric Light at the Royal Exchange.—The Lord Mayor (Mr. Alderman Tyler), as Chairman of the Gresham Committee, performed last Thursday afternoon the ceremony of turning on the current in connection with the installation of the electric light at the Royal Exchange, London. There are four arc lamps in the quadrangle, each of 2500-candle power, and an incandescent lamp of 100-candle power in each of the four corners of the ambulatory. In consequence of the building being washed down periodically by the fire-hose, the cables attached to the mains have been specially made concentric and lead-covered; and all the joints are enclosed in cast-iron boxes filled in with hot bitumen. This is the first time the interior of the Royal Exchange has been illuminated with artificial light, although great inconvenience has hitherto been experienced in foggy weather.

New Joint-Stock Companies.—The following joint-stock Companies have lately been registered: Berwick and Tweedmouth Gaslight Company, Limited, with a capital of £12,000, in £10 shares. South Hams Gas Company, with a capital of £10,000, in £10 shares, to acquire the business of the Kingsbridge (Devon) Gas Lighting Company, Limited. London Briquette Company, Limited, with a capital of £500, in £1 shares, to carry on business as patent fuel makers, briquette manufacturers, coal merchants, smelters, &c. The Lee Lamp (Parent) Company, Limited, with a capital of £50,000, in £1 shares, to carry into effect an agreement made between J. Hodgson Lee of the one part and the Company of the other part, and to carry on the businesses of manufacturers of, and dealers in, lamps and parts of lamps for lighting, heating, &c., by the agency of oil, gas, electricity, or other means; and of globes, chimneys, shades, carbons, &c.

Proposed Purchase of the Ambleside Gas and Water Undertaking by the Local Board.—Some negotiations have taken place between the Ambleside Local Board and the Gas and Water Company, with a view to the transfer of the Company's undertaking. The Local Board engaged Mr. A. Silverthorne, who valued the works, and suggested that £14,120 should be offered for them; this sum being 20 years' purchase of an average of four years' dividends. A valuation was also made for the Company by Mr. J. Hepworth, of Carlisle, whose figure was £24,000. An offer to purchase on Mr. Silverthorne's estimate, to go to arbitration on the two valuations, was made by the Local Board; but it was declined by the Company, who would not consent to arbitration on the basis of Mr. Silverthorne's figures. These facts were recently laid before a meeting of the ratepayers; and it was decided that the Local Board should oppose the Company's projected Bill in Parliament, with a view to securing clauses empowering the Board to purchase the undertaking, and in the alternative, clauses to protect the interests of consumers and ratepayers.

MISCELLANEOUS NEWS.

THE DUBLIN CITY COUNCIL AND THE GAS COMPANY.

On the 17th inst., the Dublin Municipal Council held a Special Meeting, the greater portion of the time of which was spent in a discussion on a question relating to the lighting of the city; and, from the remarks which were made, it is very palpable that some unpleasantness still exists between the Committee having charge of the lighting of the city and the Gas Company.

Alderman DILLON commenced the discussion by moving several amendments to standing orders, and the addition of the following new one: "The Lighting Committee has charge of all matters relating to the lighting of the city, and all the powers hitherto vested in the Paving and Lighting Committee in connection with lighting matters, the quality and measurement of the gas supplied to the citizens, as well as the management and all matters relating to the electric lighting undertaking of the Corporation." He remarked that the object with which he moved these amendments was to create a Lighting Committee as distinguished from the Paving Committee, and to vest the functions exercised by the Electric Lighting Committee and Special Gas Committee in a Joint Committee, which would have control of the entire lighting of the city.

Sir ROBERT SEXTON objected that the passing of these resolutions would be carrying out the recommendations of a report of the Special Gas Committee, which the members had not yet had the opportunity of discussing.

Mr. LITTLE thought that the report could not be brought forward that day.

Alderman DILLON believed that Mr. Little was a shareholder of the Gas Company; and he, therefore, appealed to him not to interfere in the discussion.

The LORD MAYOR (the Right Hon. James Shanks) did not think Mr. Little was at all precluded from exercising his functions as a member of the Council. At the same time, with regard to the matter which he raised, he (the Lord Mayor) thought the report was before the Council; it having been read a first time.

Alderman DILLON said he did not want to say one word of unpleasantness with reference to the Gas Company; but really members who were not shareholders in the undertaking ought to be left control of this question. In 1889 an award was made which they hoped would have settled all questions between the Gas Company and the Corporation. The lighting plant was directed to be handed over to the Corporation; the meter system was to be continued; and a testing-station was to be erected by the Company. The plant was taken over and a large sum of money—much larger than the Committee were advised the plant was worth—was paid for it. The Committee introduced new meters into the lamps, as provided by the award; and they sought to force the erection of a testing-station. But in all these matters they had had a continuous hand-to-hand fight with the Company. The testing-station to have been built in December, 1889, was not yet fit for use.

The LORD MAYOR thought that Alderman Dillon was now proceeding to state at full length the contents of a report which had not yet been discussed by the Council.

Alderman DILLON said he did not desire to enter into the question further than to show that the functions of the Lighting Committee would be of an important character, and of a character sufficient to give them plenty of work without having any duties as to paving.

Alderman MULLIGAN, in seconding the resolution, mentioned that the public lighting alone cost £8000 a year, and the private lighting £200,000. He thought the Corporation would act wisely in appointing a Lighting Committee that would be above suspicion. [Alderman GILL: "Oh, oh!"] Alderman Gill might say "Oh;" but they all knew that he was a Director of the Company, and had taken an active part in these matters. But he (Alderman Mulligan) thought it would please the citizens generally if no Director or shareholder of the Company was on this Committee. Shareholders had been known to go into the Committee, and copy minutes in reference to the Gas Company. It would be utterly impossible for any public Committee to carry on their business if this were done. The Committee during the last four-and-a-half years had saved the city over £5000 in the public lighting bill.

Alderman MEADE: What about the half hour you cut off the gas?

Mr. LITTLE wished Alderman Mulligan to name the gentleman who had taken away the minutes.

Mr. ROBINSON said it was stated that certain sums of money had been saved by the Gas Committee; but other members were of opinion that the reverse was the case. He suggested that the Special Committee should be augmented to 15; for he was against amalgamating with the Electric Lighting Committee, which had different functions.

Mr. THOMPSON considered there should be a Special Lighting Committee with power to deal with the Gas Company; and, if the Company were not dealing fairly with the citizens, that the Committee should have power to enforce the rights of the Corporation.

Alderman DILLON accepted Mr. Robinson's amendment.

The LORD MAYOR did not agree with the proposed changes. He admitted that it was very objectionable that shareholders or Directors of the Gas Company should take an active part in the proceedings of the Lighting Committee; but was that any reason why all members of the Committee should be stigmatized as unfit to serve on the Committee? It was evident there was more in this matter than the desire to exclude a few members of the Council. He considered that, instead of the Lighting Committee being named, the principle of rotation should be allowed to operate in reference to that Committee as well as to all others. He thought the Lighting Committee should be the Paving Committee, *minus* Directors and shareholders of the Gas Company. A confession had been made that day that the Special Gas Committee, after three or four years, had so far fallen short of accomplishing the work that they were set to do, that it was now necessary to make a more powerful organization to deal with the Gas

Company. The continued friction and expenditure of large sums of money in law costs, apart from every other question, was calculated to introduce an amount of personal bitterness into this controversy between Company and Committee that was likely to be prejudicial to the public interest; and he thought the members of the Committee who were identified with this dispute should take their departure to other Committees, and make way for gentlemen who would be able to take as just a view of the situation.

Alderman GILL said, being connected with the Gas Company, he altogether disclaimed any wish to be on the Gas Committee. He believed all these disputes with the Company could be obviated. If a small Committee of four or five gentlemen waited on the Directors, it would be vastly more effectual than all the "hugger-mugger" that was going on.

Mr. M'COY suggested, as an amendment, that the Special Gas Committee should cease to exist; that the Paving and Lighting Committee should form the Special Gas Committee; and that no shareholders of the Company should be allowed to act on the Committee.

Alderman KENNEDY seconded the amendment.

Alderman FLANAGAN said there was a personal animus on the part of some members of the Sub Gas Committee against the Gas Company; and he had seen Alderman Gill insulted by the Chairman of that Committee.

Alderman MEADE was of opinion that the lighting of the city was of sufficient importance to justify a separate Committee being constituted to take charge of it.

After further discussion, by permission of the Council, Mr. M'Coy's amendment was modified as follows: "That the Gas Committee shall consist of the members of the Paving and Lighting Committee."

Alderman DILLON denied that the Gas Committee ever admitted that they were a failure; on the contrary, he contended that they had effected a revolution in the lighting of the city, and had almost brought the Gas Company to the position in which they ought to be. However, there still remained a great deal to be done.

On a division, the amendment was carried by 18 votes to 16.

The LORD MAYOR was proceeding to put it as a substantive motion, when

Alderman DILLON proposed, as an amendment—"That the Gas Lighting Committee consist of 15 members elected annually by rotation at the first meeting in December in each year; that they appoint their own officers, and conduct their business independent of the Paving and Lighting Committee."

The LORD MAYOR ruled that Alderman Dillon was not entitled to move an amendment, having proposed the original resolution.

Mr. M'COY then moved that the question be put.

A division was taken, with the result that 13 members voted for putting the question, while 21 were against. The motion was therefore lost; and the Council resolved to adjourn.

THE PROPOSED TRANSFER OF THE KENDAL GAS AND WATER UNDERTAKING TO THE CORPORATION.

In the application which they are about to make to Parliament, the Corporation of Kendal seek powers to acquire the existing works of the Gas and Water Company, and to construct the Fisher Tarn reservoir recommended by Mr. G. F. Deacon, M.Inst.C.E. (an epitome of whose report was given in the JOURNAL last week), together with the necessary aqueducts and other works. The water from Fisher Tarn and its main feeders has been analyzed by Mr. Hellon, who reports that, while entirely free from organic matter of animal origin, it contains a notable proportion of peaty matter. He quotes Mr. Deacon's statement that, as the volume of water collected will be greatly increased, the proportion of vegetable contamination will be so much reduced that storeage in a properly constructed reservoir (supplemented, if found necessary, by filtration) will be sufficient to entirely remove the peaty taste. If the purification be carried so far as this, the water will, Mr. Hellon believes, be rendered perfectly wholesome and suitable for dietetic purposes, though perhaps still slightly yellow.

It is not without interest to see how the Corporation and the Company will be financially affected by the proposed transfer. The Corporation are to pay £80,000 for the undertaking, in addition to £5350 for the loan debt of the Company, £1370 for extensions, and £1260 for the adjustment of balances; making a total of £87,980. In addition to this, they put down £2800 as working capital, £1250 as parliamentary and legal expenses in the promotion of the Bill, and £350 the expenses of winding up the Company; making a total of £92,380 as the cost of the present undertaking. Then it is estimated that the Fisher Tarn reservoir will cost £24,800; and the filter-beds and tanks, £4000. The Corporation expect to borrow money at 3¼ per cent., and to be allowed 50 years for the redemption of the debt. The interest and sinking fund on the £92,380 will amount to £3982 per annum, while the estimated profit from the undertaking is but £3831; so that there will be a deficit of £151. On account of the expenditure on the new reservoir, a further annual sum of £1043 will be required; but as £850 will be saved by the abolition of pumping, the annual deficit on this account will be reduced to £193. If filter-beds are constructed, an additional £168 per annum will be required for the interest and sinking fund on this expenditure. The net result of all this is that, if the estimates are not exceeded, and the revenue shows no increase, there will be an annual loss to the town of £512, which sum really represents what the community will pay for an improved and abundant water supply. The fact that the estimate shows a deficit has been dwelt upon and magnified by the opponents of the purchase of the works, one of whom, by adding the cost of an electric light installation, brought up the total to £1812, or about 9d. in the pound on the rates. The feeling of this gentleman is that too much is being paid for what he described as "a worn-out business, old machinery, and a parcel of rotten pipes which had done their work long ago." However, he found only two supporters in a Council meeting of twenty members. Naturally, the supporters of the transfer look to the undertaking as an ultimate source of profit; and they are already talking of schemes by which the gas undertaking can be made to yield a larger revenue or give better results by more economical working.

The proposed disposition of the purchase-money does not give unqualified satisfaction to the shareholders of the Company, though there is not likely to be much opposition from this quarter. There are two classes of shares—preference shares of £20, and ordinary shares of £10 each. It is proposed by the Directors to give £39 for each £20 preference share. According to the Chairman of the Company, the highest price at which these are known to have been sold is £38; and he entered into a calculation to show that The Gaslight and Coke Company's 7½ per cent. preference stock is quoted at a comparative relative value of £35 12s. As to the ordinary £10 shares, it is proposed to pay for each of these £21 14s. 6d. These shares have at times changed hands at a higher rate than this; but the latest figure at which they sold was £19 19s. 10d. The amount received by the shareholders will consequently be a bonus on the market price. To this, however, exception has been taken by a shareholder who paid for his shares more than £21 14s. 6d., and who suggests that the only just and fair arrangement is to give each shareholder at least the amount which his shares cost. The feeling in this gentleman's mind seemed to be that the preference shareholders had rather the best of the bargain.

THE AMALGAMATION OF WATER-GAS COMPANIES.

A Meeting of the North British Water-Gas Syndicate was held at Glasgow last Tuesday, for the purpose of considering a resolution to wind up the concern. The Chairman (Mr. Reid Stewart) stated that the meeting was necessary in order to carry out the amalgamation of the three Water-Gas Companies agreed upon at the last two meetings of the shareholders. The new Company was now being registered under the name of the Amalgamated Water-Gas Companies, Limited; and due notice had been given to them by the Directors of that Company that they held at their disposal 60,000 fully paid-up shares of £1, and which fell to be distributed among the shareholders. As they were aware, a small section of the shareholders took upon themselves to raise an action against the Company; but Mr. Justice Kekewich dismissed it. In spite of this decision, however, two of the dissentient shareholders (Messrs. Leah and Brooke) had commenced an action in the Court of Chancery against the Directors, claiming damages against them for alleged misconduct in the management of the business, and an injunction against carrying into effect the amalgamation scheme. They obtained leave to serve their writ on the Scotch Directors in Scotland; but Mr. Justice North had discharged the application. He concluded by moving that the Syndicate be wound up voluntarily. Mr. Reid seconded the motion; and then Mr. G. F. Allan rose to address the meeting. He was, however, questioned as to whether he had paid his call; and on replying in the negative, the Chairman ruled that he was not entitled to speak. A little conversational discussion ensued, in the course of which the Directors were informed that "they stink in the nostrils of the merchants of Glasgow from the manner in which they have conducted this business." The motion was agreed to.

Subsequently a meeting of dissentient shareholders was held, at which the chair was taken by Mr. Douglas Carney, who called upon Mr. Allan to state a few facts with regard to the conduct of the Company. Mr. Allan said the dissentient shareholders formed a body representing 11,000 shares—a larger number than the Directors ever represented, apart from the 20,000 deferred shares held in the name of the Board. Therefore, had they a fair vote apart from these deferred shares, they would have been able successfully to oppose the amalgamation. As was stated at a former meeting, and passed uncontradicted by any of the parties interested in this amalgamation, by the Directors having only 10s. per share to pay in this Company, and escaping the call of £1 per share in the parent Company, Mr. Reid Stewart would save £200, Mr. John Scott £437 10s., Mr. Samson Fox over £3000, and Mr. R. Sinclair Scott £410. These gentlemen, who should be trustees on behalf of the shareholders, came forward and boasted that they managed to shuffle out of the action of their own shareholders to save this Company's money from the parent Company, and had avoided being called to account under the jurisdiction of the English Courts. It was rather hard for the independent shareholders that they should be crushed in this way; and, on appearing at the meeting that day to protest, not to be allowed to do so. As a matter of fact, £400,000 or so had been paid to the parent Company, and no one could say where it had gone. For four-and-a-half years water gas had been working; and it had not paid a thousandth part of the rent of its premises. Now the Company wished to grasp the £12,000 in the hands of the North British Company, and to screw a call of £20,000, which, they believed, would follow the other £400,000, to that "bottomless pit" from which no money would return. The shareholders did not want continued litigation, and were open to any reasonable settlement. Either let the Directors consent to a winding-up by the Court, and let the Court decide it was right, in the interests of the Company, that this amalgamation scheme should be carried through, or let the dissentient shareholders get, according to their proven numbers, a share of the £12,000 in hand, and an undertaking that there would be no further call made upon them. Then the Directors and Mr. Samson Fox could play ducks and drakes with the rest of the money. He proposed a vote of censure upon the Directors for having led the shareholders into a Company which had proved to be an utter failure, and, in the second place, when it had been proved to be a failure, having thrown good money after bad, and screwed further money out of the shareholders. Mr. J. M'Coll seconded the motion, which was unanimously agreed to.

Extensions at the Newcastle and Gateshead Gas Company's Works.—The Whessoe Foundry Company, Limited, have in hand for the Newcastle and Gateshead Gas Company a large roof of 100 feet span, stage-flooring, and two bridges of 100 feet span, to connect the retort-houses and carry the locomotives and coal-trucks.

THE NEW HOLDER FOR THE NEWCASTLE AND GATESHEAD GAS COMPANY.

The new holder which has for some time been in course of construction at the Redheugh works of the Newcastle and Gateshead Gas Company is now finished, and has successfully passed the usual tests before being brought into use for storing gas. It has been erected, from the plans and specifications of Mr. V. Wyatt, the Company's Consulting Engineer, by the Whessoe Foundry Company, Limited, of Darlington; and its capacity is upwards of 3 million cubic feet. The holder is in three lifts—the outer one being 180 ft. 10 in. in diameter and 43 ft. 9 in. deep; the middle one, 177 ft. in diameter and 42 ft. 9 in. deep; and the inner one, 174 ft. 4 in. in diameter and 42 ft. 9 in. deep. The crown has a rise of 11 feet at the centre. The total height of the holder, from the tank coping to the top of the crown, is 136 ft. 9 in. The sheeting plates are principally $\frac{1}{8}$ inch thick, excepting those for the curbs, cups, and grips, which vary from $\frac{1}{4}$ to $\frac{1}{2}$ inch in thickness. The top curb to the inner section of the holder, which takes the compression strain of the crown, is formed of steel plates $\frac{1}{2}$ inch thick, curved to form a quadrant, into which are fitted the vertical stiffeners and gussets; and the plates are double covered at the butt joints, and riveted in four lines of rivets throughout. On the top of this curb are riveted and fitted the 16 pairs of guide carriages and rollers; the other lifts of the holder having a corresponding number of pairs of guides. The guide-framing consists of 16 steel standards, the main angle-irons of which are 8 in. by 8 in. by $\frac{3}{4}$ in. at the base, and 6 in. by 6 in. by $\frac{5}{8}$ in. at the top; the diagonal channel-irons are 5 in. by 2 in. by $\frac{1}{2}$ in.; and the horizontal stiffeners are T-irons, 5 in. by 3 in. by $\frac{1}{2}$ in. There are three rows of horizontal girders to the guide-framing, corresponding to the three lifts of the holder, of the single lattice type, formed of double angle-irons, 5 in. by 4 in. by $\frac{1}{2}$ in., to the top and bottom, and united by the channel-iron lattices, 5 in. by 2 in. by 2 in. by $\frac{3}{8}$ in. The steel is of the Siemens-Martin quality. The riveting throughout the structure, both for the holder proper and the guide-framing, and also including the thin sheeting-plates, was performed with hot rivets; and the holder is believed to be the only example where cold riveting has been dispensed with. The moveable part of the holder weighs about 600 tons; the guide-framing, about 400 tons—making a total gross weight of about 1000 tons of wrought iron and steel. The tank, the construction of which was described by Mr. Wyatt at the meeting of the North of England Association of Gas Managers at Newcastle in April last year, is 184 feet in diameter by 44 ft. 3 in. in depth, and is built of Portland cement concrete and brickwork. The contract was entrusted to Messrs. Walter Scott and Co., of Newcastle-on-Tyne. The whole was carried out under the superintendence of Mr. Moodie and Mr. Gibb, the Company's Managers at Redheugh. The new holder is the largest in the northern counties; and the cost of it, with tank and connections, will not be far short of £30,000. The entire storeage power of the Company will now be 10 million cubic feet; being equal to the heaviest day's make of gas in winter.

THE PROPOSED RECONSTITUTION OF THE THAMES CONSERVANCY BOARD.

In our article on "Water and Sanitary Affairs" last week, reference was made to the notice published by the Conservators of the River Thames of their intention to promote a Bill in the ensuing session to obtain authority, among other things, to alter their constitution. An outline of the Commissioners' scheme was then given; and we now supplement it with the following particulars:—

The notice, which is of considerable length, specifies at the outset that the expression "River Thames," or river, includes the Thames from its source at Thames Head, in Gloucestershire, to Yantlet Creek, in Kent, including all backwaters, creeks, side channels, bays, and inlets connected with the river, and that it will or may include all tributaries, rivers, streams, watercourses, cuts, docks, canals, channels, and waters communicating either directly or indirectly with the river, and its locks, weirs, and other works, foreshores, shores, banks, and towpaths. It then states that the Conservators wish for a reconstruction of the Board as constituted under the various Acts relating to it, as well as under the London County Council (General Powers) Act, 1893. Authority will be sought to continue, reduce, or increase the present number of Conservators representing the several interests on the Board, and to abolish or alter the right of any person to be a Conservator, or of any body or persons to nominate, appoint, or elect Conservators; also to empower any bodies or persons already represented to nominate, appoint, or elect members on the Board, and to provide for the representation of such other bodies or persons as may be prescribed in the Bill to be determined by Parliament. The powers, rights, duties, and qualifications of the members, and the mode of voting are to be defined. With the view of more effectually preventing the pollution of the river, it is proposed to amend the provisions of a number of Acts, and to provide, for the total discontinuance of the flow of sewage or offensive or injurious matter into the stream or any of its tributaries. Additional powers are to be applied for by the Conservators with regard to the inspection of lands and premises, sewage farms, &c. The notice further specifies the following among the numerous objects of the Bill: "To provide for, authorize, require, and compel contributions or payments, in such proportions and modes as may be provided in the Bill, or as Parliament may determine, to the funds of the Conservators towards the maintenance, improvement, and purification of the river, and such objects and purposes as may be specified in the Bill, and the carrying out and fulfilment of all or any of the powers, duties, and obligations of the Conservators, from the London County Council, and the respective County Councils of Kent, Essex, Middlesex, Surrey, Berkshire, Buckinghamshire, Oxfordshire, Wiltshire, Gloucestershire, Hertfordshire, and Hampshire, the Corporations of West Ham, Croydon, Richmond (Surrey), Reading, Windsor, and Oxford, the various Local, Rural, and Urban Sanitary Authorities having jurisdiction in any of the aforesaid counties, the Corporation of the City of London, the Commissioners of Sewers of the City of London, the Governor and Company of the New River, brought from Chadwell and Amwell to London, commonly called the New River Company, the Company of Proprietors of the East London Water-Works, the Southwark and Vauxhall Water Company, the West Middlesex Water Company, the Lambeth Water-Works Company, the Governor and Company of the Chelsea Water-Works, the Grand Junction Water-Works Company, the Company of Proprietors of the Kent Water-Works, the Rickmansworth and Uxbridge Valley Water Company, the Leatherhead and District Water-Works Company, the West Surrey Water Company, and the South-West Suburban Water Company, the Barnet District Gas and Water Company, the Central Middlesex Company, the Colne Valley Water Company, the East Surrey Water Company, the Epsom Local Board, the Sutton District Water Company, the Uxbridge Local Board, the Cheshunt Local Board, the Enfield Local Board, the South Essex Water Company, the Tottenham Local Board, the Hoddesdon Water-Works Company, the Ware Local Board, the Limpsfield and Oxted Water Company, and from such other bodies, companies, and persons now or hereafter taking water either directly or indirectly from the river as may be named in the Bill or be determined by Parliament. To impose and confer upon the before-mentioned bodies and persons, and the other bodies and persons to be named in the Bill, all necessary obligations and powers for obtaining and raising, either by loan, rating, or otherwise, and applying the moneys required for such contributions and payments, and upon the Conservators for collecting and recovering the amount of such contributions and payments. To empower the Conservators to prohibit the before-mentioned and all bodies and persons from abstracting water directly or indirectly from the river in excess of the quantity from time to time authorized to be taken by them, or in excess of a quantity to be named in the Bill; and to control and regulate the taking of water by any bodies and persons either directly or indirectly from the river, and from any lands and wells under, adjacent, or near thereto, or within such limit as may be named in the Bill. The Bill will or may contain provision by which the quantity of water taken from the river can be better and more efficiently checked; and for that purpose it will or may provide for, require, and compel the fixing and maintenance of gauges, fittings, or appliances by the aforesaid bodies and persons abstracting the water, with power to the Conservators to inspect, control, make, and enforce regulations concerning the same." In order to carry out the objects of the Bill, the Conservators will ask for an extension of their borrowing powers.

PROPOSED ADDITIONAL PERMANENT WATER SUPPLY FOR THE CITY OF DUBLIN.

There was an important discussion on the water question at the meeting of the Dublin City Council on Monday, the 13th inst. It was initiated by Alderman Dillon, who moved a resolution authorizing the Water Committee to take all steps requisite for procuring a permanent additional supply of water for the city and adjacent townships, and to take the necessary proceedings for obtaining a Provisional Order. In a speech of considerable length, he related the history of the present supply. For close upon thirty years, he said, the city had been supplied from the River Vartry, and two or three small tributary streams which flowed into it; but in reality the supply was taken from an area of land of 14,000 acres in extent. When these works were first started, the service was limited to the city; and by degrees it had been extended to the out-townships. The supply had stood the test of thirty years; but they were now face to face with a position that required to be grappled with in the most energetic manner. They would be able, he trusted, to tide over this year by the temporary arrangements which they were making; but he thought the Council would be criminal in the extreme if they allowed another year to pass by without taking steps to supplement the supply they had, or at all events if they did not do so in the very near future. The Committee had before them two suggestions. One was that they should bank up the River Vartry to a higher level than at present, and that they should construct an embankment similar to one which now existed at a place called Watersbridge at the top of the present reservoir. This would have the effect of banking up the river, and flooding about 500 acres of land; and they would have the reservoir as large again or a little larger than the existing one. The other suggestion was to take the water of Lough Dan. There were certain factors common to both schemes which enabled the Engineer approximately to say that the banking up of the River Vartry and the construction of a second reservoir would cost from £80,000 to £100,000. This included the purchase of 500 acres of land; and in this lay the largest amount of compensation. The circumstances in connection with Lough Dan, while some of them were similar, were wholly dissimilar in that respect. An embankment could be erected at the mouth of the lake at no greater cost than the one which they would have to erect upon their ground at Roundwood at their own reservoir. The limit to which they would have to bank, would be 40 feet; but possibly it would not be necessary to raise it to anything like that height. The land required would be very much less expensive than that needed for the reservoir. On the other hand, they had a large item. A line of pipes would have to be laid from Lough Dan to the filter-beds, and the water carried along by gravitation. The additional outlay on this line was estimated to be about £35,000. At the inquiry by the Royal Commission into various water schemes in 1860, the waters of Lough Dan and of the Vartry river seemed to have been regarded as practically the same; and in some respects Lough Dan was believed to be slightly superior. They were now feeding with water a population of 340,000. He considered that the scheme which he hoped they would now enter upon would be able to supply the needs of at least twice that number. Whether the expense be £100,000, £120,000, or £150,000, they were

bound to undertake this work. They could now borrow £100,000, repayable in sixty years, at a rate, including sinking fund and interest, equal to £4000 a year, or something less than 1½d. in the pound upon the city taxes. When they remembered this fact, he did not think that anybody would complain that they were undertaking a work beyond their resources or what the necessities of the case demanded. The motion, which was seconded by Alderman Meade, was supported by the High Sheriff. The Lord Mayor (the Right Hon. J. Shanks) objected to the motion, on the ground that it simply meant the Council should hand to the Water Committee all their powers of control over the question of the extension of the water-works. He did not think the water supply of the city was in such a condition as to warrant any haste in the matter. The last few weeks had demonstrated that there was available, at a moderate cost, from the higher levels of the canals, a supply of 5 million gallons daily of perfectly pure water. Some time ago the Corporation authorized the construction of a second-pipe line to Stillorgan, at a cost of £110,000. When that work was completed, they would be in a position to fill the Gray reservoir at Stillorgan, and maintain it at that level during the remainder of the year. The result would be that they would have 198 million gallons available at the Stillorgan reservoirs, instead of 98 millions. Then, he contended that, of the 40 gallons per head per day of Vartry water supplied to the city, 10 or 15 gallons found its way into the subsoil or into the Liffey, without having served any useful purpose whatever. Alderman Dillon pointed out that the resolution was not intended to do anything more than obtain powers to get a Provisional Order. Mr. Thompson and Alderman Gill did not think the Committee would be justified in incurring the proposed enormous expenditure; but Sir Robert Sexton was of a contrary opinion. After some additional discussion, the resolution was amended, so as to authorize the Committee to take the necessary preliminary steps towards obtaining a Provisional Order or Act of Parliament, as they might determine, for the purpose of securing Lough Dan as an additional source of water supply for the city; but no further steps were to be taken until a detailed report setting out the merits and cost of the scheme was placed before the Council for consideration. This was carried; and afterwards the Committee were empowered to take all necessary steps for procuring such further temporary supplies as they might think requisite.

Rain has fallen very heavily in the Roundwood district during the past ten days; and this has made a considerable difference in the level of the Dublin Corporation water reservoir. According to Alderman Dillon, it may now be unnecessary for the Corporation to spend £5000 upon the temporary works.

The Kingstown Township Commissioners held a special meeting on the 18th inst., at which it was agreed to apply for a Provisional Order, to obtain powers for procuring an independent supply of water for the use of the inhabitants of the district; and, if deemed advisable and expedient, a supply for the townships of Bray, Killiney, Blackrock, Ballybrack, Dalkey, and Pembroke, or some one of them, and the promotion of a Joint Board or Committee for the purpose.

METROPOLIS WATER SUPPLY.

The Quality of the Water in the Month of October.

The returns furnished to the Registrar-General by the London Water Companies with regard to the water supply of the Metropolis during the past month, show that the average daily supply was 188,788,084 gallons, as compared with 182,601,846 gallons in the corresponding month of 1892. The number of services being 799,313, the rate was 236 gallons to each service. Of the entire bulk of water sent out, 96,830,115 gallons were drawn from the Thames, and 91,957,969 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies was: Kent, 0·5; New River, 1·2; Colne Valley, 1·3; Chelsea, 1·6; East London (deep well), 1·7; West Middlesex, 2·2; Grand Junction and East London, 3·1; and Southwark and Lambeth, 3·2. The unfiltered river waters contained the following proportions: New River Cut, 1·9; East London intake, 4; and the Thames at Hampton, 6·6. The Thames at Hampton was, on Oct. 19, turbid and of a pale brown colour. It was, both chemically and especially bacterially, of very much worse quality than on Sept. 25. Contrasted with the unfiltered water, the supplies of the five Companies drawing from this river showed very great chemical, and the following percentage bacterial improvement: Chelsea, 99·94; West Middlesex, 99·93; Southwark, (No. 3 filter well) 99·92, (gravel water) 99·51; Grand Junction, (Hampton filter well) 99·48, (Kew Bridge general well) 99·67, (Kew south well) 99·54; and Lambeth, 99·89. The water was in every case efficiently filtered; while that delivered by the Chelsea Company was equal to deep-well water in chemical purity. The unfiltered water, taken chiefly from the River Lea by the New River Company, was, on Oct. 20, turbid and very pale yellow. Considering the season of the year, it was chemically of very good quality, but bacterially about 100 per cent. worse than on Sept. 26, although still six times better than the Thames at Hampton. It was efficiently filtered before delivery, and was improved chemically 30 per cent., and bacterially 98·68 per cent. As supplied to consumers, it was fully equal to deep-well water in chemical purity. The crude river water taken from the Lea at Angel Road by the East London Company, was, both chemically and bacterially, considerably inferior to that collected at the same place on Sept. 26. It was efficiently filtered before delivery, and was markedly improved in respect of chemical purity. The number of bacteria per cubic centimetre was reduced to the extent of 98·92 per cent. by comparison with the raw river water. The deep-well waters of the Kent, Colne Valley, and East London Companies were of excellent quality for dietetic purposes. They were clear and bright without filtration; and the Colne Valley Company's water was softened before delivery, and thus rendered suitable for washing. No sample from the Tottenham Local Board of Health was received this month. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and East London (deep-well) waters were clear and colourless; the Chelsea and New River, clear and nearly colourless; the West Middlesex, clear and very pale yellow; and the remaining waters, clear and pale yellow. The bacterioscopic examination of the raw river waters, and of those supplied by the various Companies, collected on the 19th, 20th, 21st, and 23rd of October, gave, when submitted to Koch's process of gelatine plate culture, the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw River Waters.		
Thames at Hampton	13,790	12·5
New River Cut	2,276	11·7
Lea at Angel Road	5,368	11·8
River Supplies.		
Chelsea	8	13·5
West Middlesex	10	12·3
Southwark, No. 3 filter	11	14·2
" unfiltered gravel water	68	13·8
Grand Junction, Hampton well	72	13·5
" " Kew general well	46	12·5
" " " south well	64	12·4
Lambeth	15	13·4
New River main well	30	12·7
East London, No. 1 Essex well	58	12·4
Deep Well.		
Kent, new well	20	10·3

In the course of their report for the past month to the Official Water Examiner (General A. de Courcy Scott, R.A.), Messrs. Crookes and Odling say: "Of the 182 samples examined, all were found to be clear, bright, and well filtered. A comparison of the average composition of the five Thames-derived waters during last month with that of the same waters in October, 1892, shows a decided improvement in the amount of nitrates, in the oxygen required to oxidize the organic matter, and in the organic carbon. Notwithstanding a somewhat heavy rainfall, the composition of the waters during last month is almost identical with that recorded in September, when the Thames waters were of a wholly exceptional degree of purity; the increase in organic carbon in October over that in September only amounting to 1 part in 7,000,000 parts of water, as will be seen by the following table, giving the averages of the five supplies derived from the River Thames:—

	Common Salt per Gallon.	Nitric Acid per Gallon.	Hardness degrees.	Oxygen required per Gall.	Organic Carbon per Gall.	Organic Carbon per Gall.
Sept..	2·163	0·570	13·64	0·026	0·057	0·071
Oct.	2·197	0·665	14·10	0·031	0·067	0·099

Colour.—Sept.: 12·2 brown: 20 blue. Oct.: 13·8 brown: 20 blue.

Note.—All the figures are means except those in the last column of the table, which are maxima.

The rainfall in the month of October at Oxford* was very near the mean fall for the month over an average of 25 years. The actual fall was 2·65 inches, while the mean is 2·56 inches. Most of the rain occurred in the early part of the month; 1·9 inch, or 72 per cent., falling in four days. Although this heavy rain immediately followed an exceptionally dry month, the self-purifying power of the running stream and the aërating and filtering arrangements of the Companies have proved amply sufficient to prevent any rise in organic matter; our analyses showing no variation in the uniform good quality of the water between the first and the second half of the month."

THE NEW WATER-FILTERS AT HAMBURG.

Our readers may remember that, after the recent serious outbreak of cholera at Hamburg, the virulence of which was largely attributable to the water of the Elbe, with which the city is supplied, it was decided to make some important alterations in the filtering plant at the water-works. The following particulars in regard to the work are taken from an address delivered by Herr F. A. Meyer, Chief of the Technical Department, and from material supplied to the *Engineering Record* by Herr Otto Iben, of the Water-Works Department.

The pumping plant in Rothensburgsort contains seven steam-pumps of about 1800-horse power; and its average daily delivery during the year 1891 was upwards of 34 million gallons, occasionally rising for single days to more than 39 million gallons. Assuming a population of 584,000, this is equal to an average daily consumption of 58 gallons per head. The water of the Elbe is stated to be quite soft, and to contain but a very small mixture of organic matter. In the new purifying plant, the water will be taken from the river at a point about 7900 feet above the present intake. From the pumps it flows into an open receiving-basin, and then passes through an open channel into the settling-basins, from which, after resting for 21 hours, it goes through a covered main and its branches to 18 filter-basins. Here it will eventually be filtered at the rate of 2½ inches an hour, although at first the speed will be much higher. From the filters the water will pass to the main pumps through a new main and the existing main, which crosses an arm of the river by means of an inverted system of wrought iron. The old main is provided with a covered clear-water reservoir of 2,640,000 gallons capacity, in which enough pure water can be stored to equalize the variable draft, which would otherwise be felt at the filters. The works under construction are designed to provide a daily supply of 47,500,000 gallons; but they can be extended to furnish nearly double this amount, if it should appear essential.

The elevations of the different parts of the new works are fixed

*Oxford has been chosen in preference to London, as its rainfall more closely represents the average fall over that part of the gathering-ground of the Thames Valley which supplies the chief sources of the river.

necessarily by the portions of the existing plant which it is proposed to utilize. The pump-wells at Rothenburgsort are from 8 to 15 feet above the city datum; and the clear-water reservoir, therefore, has its bottom at a height of 8·5 feet. The bottom of the filter-basins is at 10·8 feet, and their water-level at 19·7 feet; the bottom of the settling-basins is at 16·4 feet, and their water-level at 27·6 feet. The pumps raise the water to a height of 28·6 feet. The mean high-water level of the Elbe is at 26·7 feet; and the mean low-water level, at 10·8 feet. The highest flood recorded was 28·6 feet; and the lowest stage of the river, 5 feet. Consequently, it was necessary to build dykes up to a level of 31·2 feet around the works, which are located on ground from 16 to 18 feet above the city datum. In this manner, an area of 136 acres has been enclosed for settling-basins, and 111 acres for filter-basins.

The circular intake of the new works is 590 feet long, and is built of four courses of brick laid on a concrete foundation between sheet piling. Its river end is protected by face and wing walls. An iron grating can be placed across this mouth when desired. The invert of the intake is at a height of 3 feet, and its top at 10·8 feet. Its diameter is 7·87 feet; consequently, the mouth is entirely below the mean low-water level of the river, and the invert is 2·3 feet below the lowest stage of the river yet noticed. In order to ensure additional safety at the point where the intake crosses the dyke, there is a manhole at this place, and also two additional manholes about 40 feet farther along, where connection can be made to other intakes if they should prove necessary at any time in the future. At the pumping-house, the intake ends in a screening chamber. The pumping plant consists of two symmetrical halves, with a common chimney. The buildings are of brick on pile foundations, with pump-wells on a concrete foundation on piling, and surrounded by sheet piles. The boilers are four in number, 7·6 feet in diameter and 26·8 feet long, provided with two flues, which give a total heating surface of about 860 square feet. The boiler pressure is 88 lbs. The chimney is 131 feet high, and has a clear width of 6·6 feet. It rests on a concrete foundation 23·6 feet square and 6·6 feet thick, supported on 36 piles.

The pumping-station contains five horizontal compound pumps, with 14·5-inch high-pressure, 21·3-inch low-pressure, and 22·8-inch water cylinders, with 28·6-inch stroke. Each engine drives two direct-coupled double-acting piston pumps with Riedler valve-gear. Their suction-pipes draw from a long well 20 feet wide, which runs longitudinally across the end of the pumping-station. The water-level will fall at but rare intervals, and then only for a few hours at a time, below 6 feet; consequently, as the pumps must lift the water to a height of 28·6 feet, their greatest lift will probably be about 22 feet. The nominal capacity of each pumping-engine is estimated at about 11,900,000 gallons daily; so that the total of 47,500,000 gallons can be supplied by four engines, leaving the fifth in reserve. A covered drainage channel, 3·94 feet wide, and 1800 feet long, drains the works into the old Dove-Elbe.

The receiving-basin is rectangular in plan, 118 feet long, and 26 feet wide. It has sloping masonry sides and a trough-shaped masonry bottom resting on puddled clay. The depth of water in the basin is about 10½ feet. From it the water flows in an open channel 2400 feet long to the settling-basins. The channel is 6·9 feet deep, and averages about 26 feet in width. The sides have an inclination of 1 to 2, and, like the slightly-dished invert, are formed of tile on a layer of 4 inches of clay puddle, harder brick being used on portions liable to damage by ice. In addition to this channel, there is also a connection by which the water can pass directly from the pumps to the filters, in case it is necessary to throw the settling-basins out of use at any time.

The water flows from the main channel through a short arched channel 5·25 feet in diameter into a round masonry gate-house 9 feet in diameter, where it passes into the settling-basin through a vertical cast-iron cylinder 43 feet in diameter whenever the attendant raises the double valve. The gate-house always remains full of water. In case the water-level in the settling-basin is brought to its normal elevation of 27·6 feet, the double valve is closed—all manipulation being done by hand. The basins themselves have side slopes of 1 to 3, and are built with a 4-inch layer of clay covered by tile, except in portions exposed to the ice, where hard brick is employed. Owing to the slight difference in level between these basins and the filters, the water can only be drawn down to within about 4·25 feet of the bottom of the former; consequently, there is plenty of room for the sludge to collect. When necessary, this sludge can be drained off through a 3-feet cast-iron main, which leads to the old Dove-Elbe, and is provided with a check-valve at the end, and a gate. The clarified water passes through a double gate similar to that in the inlet gate-houses, which can be operated by hand, if desired. Since, however, the water in the filter-basins is supposed to stand at an elevation of 19·7 feet, it is necessary to have some special automatic apparatus which will always keep the water in the effluent channel at a constant level. This apparatus consists of a float, which entirely closes the double valve when the level of the effluent is at 21 feet. Both the inlet and outlet gate-houses of the settling-basins have small manholes giving access to the channels. The capacity of each of the four basins is approximately 20,750,000 gallons; hence it will take the pumping plant about 10½ hours to fill the basins, assuming that four of the engines are working. The water is allowed to settle for 21 hours before being drawn off to the filters; hence it is a simple matter to calculate the cycle in which the basins work. The 16 filter-beds in use at one time, each about 81,000 square feet in area, working at the rate of 2½ inches an hour, will furnish 125,600 gallons an hour each, or about 2,000,000 gallons in all; hence each settling-basin will provide water for about 10½ hours, and each basin will be filled once in every 42 hours.

The effluent channel from the settling-basin to the filter-beds at the pumping-station is partly of rammed concrete and partly of brick masonry, surrounded with a 4-inch layer of clay. It is 9000 feet long, and 8½ feet in diameter, except at the filter-beds, where it gradually diminishes in size to 5·25 feet. A number of short lateral channels, 3 ft. 11 in. in diameter, conduct the water from the main channel to the influent gate-houses, a short branch 2 ft. 8 in. in diameter running from the lateral channels to the gate. The gate-houses are built on a concrete bed about 20 inches deep; and the whole foundation and lower walls are surrounded with a filling of clay from 4 to 8 inches thick. The pit or well is divided into two parts by a partition wall. In the first is a double valve, and in the second a float, connected with the valve-rod by a lever. These parts are so designed that, when the water in the filter-bed is at a height of 19·7 feet, the water is automatically prevented from entering through the valve. The exit from the second chamber to the filter-basin is through two openings in the wall. When it is necessary to drain the bed for cleaning, the influent gate can be closed by a spindle and hand-wheel. The water is drained off through an iron pipe to a brick sewer, which is nearly 4 feet in diameter, and is pumped into Billwärder Bay. The pumps for this purpose are placed in a building which also contains an elevated tank of 33,000 gallons capacity, where the water for washing the sand is stored.

The arrangement of the filtering material is as follows: The water, which stands 3·6 feet above the bed, must pass through a layer of sand, 3·25 feet thick when first placed in position, but diminishing in thickness by the removal of fouled surface portions to a minimum of 2 feet. When reduced to this depth, the bed is brought up to its original level by the addition of the sand removed in this manner, which has meanwhile been thoroughly washed. The layer of sand rests on 2 feet of gravel, of which the separate pebbles increase in size downward. The main collector runs from the inlet to the outlet gate-houses, and has a small special foundation. It is 32 inches wide and 22 inches high, with brick side walls and a granite covering plate. The branch collectors are made of brickwork only. All these drains lie in the gravel, and are not in contact with the sand at any point; the water entering them through narrow slits in the top and sides. The water passes through the main collector to the effluent gate-house, where its passage to the clear-water main, 5·25 feet in diameter, is controlled by two gates.

All the filters are built in open instead of covered basins, on the ground that they will be more easily managed; and the action of light and air on the still unpurified water will probably have no injurious effect. The water will be warmed considerably during the summer months; but it is expected that its long underground passage to the city will effectually cool it again. The experience at Altona has also shown that there is little probability of trouble with ice during the winter. The ground on which these filters are being constructed is not very firm; and inclined rather than vertical sides were largely adopted for this reason. Moreover, the site of each bed was further improved by a 24-inch bottom layer of clay, the whole protected with brick, laid flat on the bottom and on edge on the slopes; clinkers being used where ice would be apt to do damage. The top of the brickwork is protected by a concrete coping. To drain the clay bottom during the construction of the filter, a system of pipes was placed in the underlying sand, which discharged into the drainage pumping-station.

The sand for the filters comes from Holstein, and is loaded at the island on cars after the gravel has been screened out on a shaking-screen under a stream of water. The cars carry it to a washing-drum: This is inclined in such a manner that the sand is given an upward motion by means of a screw. Water constantly flows down the drum, and washes the sand thoroughly in its passage. After the material has left the drum, it is loaded on open cars, and transported in this way to the place where it is used. The gravel is washed in a similar manner to the sand, but is fed into the top instead of the bottom of the drum. From this washer it passes to two shaking-screens, where it is separated into three heaps. Each filter has an area of 80,730 square feet; so that, with a rate of filtration of 2½ inches an hour, each bed will furnish nearly 126,000 gallons an hour, or 3,021,000 gallons in 24 hours.

While the valve in the inlet gate-house keeps the water-level continually at 19·7 feet, the effluent gates are to be arranged so as to give the rate of filtration which experience shows to be best adapted for the material. For this purpose the gate-house contains four wells, through each of which the water must pass. The first communicates through the main collector directly with the filter, and is separated from the second by a weir wall and a moveable shutter, 3·28 feet wide, which enables all flow from the filter to be stopped if desired. This shutter is operated by hand; and its proper position is determined by a ball fastened to it at a distance of 3·28 feet by an arm, and held at such a height that, when it is half submerged in the water of the first chamber, the amount of flow over the gate will be such as to give the proper rate of filtration. With a lowering of the water-level in consequence of the formation of a film over the sand, the gate must be lowered, and *vice versâ*. The water passes from the second to the third chamber through a reducer or conical pipe, which throttles the flow, and is expected to keep the level in the third chamber slightly below that in the second. Automatic gauges are to be provided for keeping a record of this difference in level; and in this way it is believed that the quantity of water passing from a filter at any time can be accurately determined. The contents of the third chamber are discharged into the fourth through an iron pipe provided with a gate-valve; and from the fourth chamber through a brick conduit, 2·6 feet in diameter, into the clear-water main. In order to bring a filter-bed into use after it has been cleaned, there is a gate-valve of the usual type placed between the first and second chambers of the gate-house.

The smaller clear water channels lead to a main, 8½ feet in diameter, extending for about 2460 feet along the Elbe. It connects with the old main through which water is pumped into the city. This main is 7·7 feet in diameter, and crosses the Billwärder Bay by means of a wrought-iron inverted syphon, 6½ feet in diameter. On the other side of the bay, the water enters an elliptical brick main 15·7 feet high and 13·3 feet wide.

With the completion of three settling-basins and ten filter-beds, working the latter at the rate of 4 inches an hour, and keeping eight in service at a time, it was expected that a daily supply of 37 million gallons of fairly good water could be supplied without much trouble. Since such a rapid rate of filtration would make it necessary to have some means of equalizing the variations in draft, the construction of the clear water reservoir has been pushed forward. The bottom is of concrete, 24 inches thick, resting on puddled clay, and strengthened by a grillage of angle-iron crossing at right angles. The roof is a series of arches supported on masonry piers, and provided with ventilating shafts. Two brick channels connect the elliptical delivery-main with this reservoir, and suitable weirs enable the quantity of water flowing to the pumps to be regulated to suit the demand.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The great storm in the end of the past week, as stated in my last "Notes," caused a temporary stoppage of the supply from one of the gasholders in Arbroath, and also wrecked the gas-works at Carnoustie. Judging by the damage done, it would appear as if the gale had been more severe in the central district of Scotland than anywhere else. In some places in Perth and Forfarshire, so many trees have been blown down that the appearance of the landscape is altogether altered. It was in this district, too, that anything like serious damage was inflicted upon gas-works. The greatest destruction was at Carnoustie, where the retort-house has been reduced to a ruin, by the fall of a chimney. The occurrence took place about one o'clock in the morning. One man was in the retort-house at the time, and was firing a retort, when he heard a noise which alarmed him; and he got outside just in time to escape being buried under the fallen material. The chimney was 70 feet in height. It fell along the whole length of the retort-house, broke the hydraulic main, a number of the ascension-pipes, and some of the mouthpieces. With such a calamity, and on such a night, there was great danger of fire arising. Sparks were continually blown out of the unprotected furnaces by the fierce blasts of wind; and as whatever gas there was in the retorts at the time of the disaster escaped, it required very little contact with flame to have set up a conflagration. The Manager (Mr. George Caithness) and his staff, by hard exertion, cleared away what woodwork they could from the front of the retort-bench, and averted the danger—the fires being allowed to burn themselves out. The Company at once issued handbills, intimating their inability to supply gas in the meantime. At the Broughty Ferry Corporation Gas-Works, a few miles to the south of Carnoustie, the largest of three gasholders—of a capacity of 90,000 cubic feet—was blown out of position. The pulleys left the guiding-rails, and the holder swung round to the extent of about a yard. The holder was knocked about a good deal, and bumped against the masonry of the tank, by which holes were made. There were about 15,000 cubic feet in the holder at the time; and part of it was lost. Mr. Thomson, the Manager, got the holder righted on Saturday morning; and he was able, by means of the other holders, to keep up the supply of gas for domestic purposes, but on Saturday night only a few of the public lamps were lighted.

The Special Committee of the Falkirk Town Council, which was appointed last week to negotiate with the Directors of the Gas Company, with a view to avoiding a parliamentary contest in the proposed transfer of the Company's undertaking to the Corporation, have had a meeting with the Directors. The proposals of the Committee were laid before the Directors; and it is announced that, after consideration of them, the Directors came to the conclusion that they were of such a nature as they could not accept. Whatever further proceedings are taken, therefore, must be of a hostile nature.

Mr. R. S. Carlow, of Arbroath, has followed Mr. T. Douglas Hall, of Montrose, in declining the invitation of the Forfar Gas Corporation to inspect their gas-works and report upon them. The Corporation have now resolved to call in Mr. Turner, of Airdrie; and this gentleman is certainly placed in an invidious position by the refusal of the two first named to act. Why they declined, has not been stated; but they must have had a reason, and a very potent one, else they would not both have replied so promptly as they did, stating that they could not do what was asked of them. When Mr. Carlow's refusal was reported to the Corporation on Monday, the proposal was made that no inquiry be made; but the burgh Treasurer insisted that it was necessary to let the community know what was wrong. Another gentleman said the inquiry was to be into the large quantity of coal that was required last year, in order that they might determine whether it was the plant or the Manager that was to blame. That is not a very intelligible subject for inquiry. I can imagine that very few gas managers would care to take up an investigation in which the question was put in that way. It is just equivalent to saying to the reporter that he is to consider whether, in his opinion, the Manager is fit for his duties. Now that is a point which the Corporation should be able to answer themselves, without outside expert advice. The question of whether the gas-works require extension or renovation is another matter; and if that were what the Corporation wanted to be informed upon, there should not be much difficulty in getting somebody to assist them.

The Corporation of Dundee have given notice of their Bill for consolidating public departments in the city, which has been long talked about. It is proposed to make both the Water Trust and the Gas Commission Corporation departments, by enacting that their business shall be transacted by the Corporation, and that the Town Clerk shall be the Clerk to them. The office of Clerk to both these bodies will be abolished. It is also proposed to take power to convert irredeemable into redeemable debenture stock.

Another step was taken on Tuesday in the amalgamation scheme of the Water-Gas Companies, by the holding of a meeting in Glasgow. Of course, the Directors carried their motion for the winding-up of the North British Syndicate prior to the amalgamation; the Chairman declining to allow anyone who had not paid his calls to speak. As probably nobody except the Directors have paid these calls, this ruling had the effect of cutting off discussion. Thereafter the dissentient shareholders held a meeting, at which some very strong language was used regarding the policy of the Directors. Another meeting is to take place in three weeks, to confirm the resolution. A Liquidator will then be appointed to wind up the present Company. The opportunity of the dissentient shareholders should come whenever the Liquidator seeks to enforce payment of calls. It is unlikely they would escape liability; but if they objected to pay, and when taken into Court moved for inquiry, they might get it. If they did get an inquiry, they could have their heart's content of the Directors and promoters when they got them into the witness-box.

The Police Commissioners of Largs have not proceeded with the adoption of the Burghs Gas Supply (Scotland) Act; and therefore the proposed acquisition of the Gas Company's undertaking by them is dropped. Before the municipal election, the inhabitants in public meeting approved of the proposal; but when it came before the Police Commissioners (eight in number), only four supported it, while three opposed, and one declined to vote. In order to carry a motion in favour of adopting the statute, a two-thirds majority is required; and this was not obtained on the occasion.

Electric lighting "never is, but always to be," cheap. The latest on that head which I have heard is contained in a statement to the Edinburgh Town Council on Tuesday by Mr. Mackenzie, the Convener of the Electric Light Committee, that a new arc lamp had been brought out which could be turned down one-half. Mr. Mackenzie imagines that this would lead to a saving of one-half the cost of a lamp, which it is difficult for anyone who is not an enthusiast to understand, because, if the lamps are full on till midnight, and are then turned down half for the remainder of the night, that should only, at the most, save one-quarter of the cost. Mr. Mackenzie's reasoning is very disingenuous—in fact, it reads like the second edition of a dream. There will, he says, be 782 gas-lamps replaced by 148 arc lights. The 782 gas-lamps cost £1310 a year; but if £68 were deducted in respect of office charges, the cost of gas would be £1241. The 148 arc lamps, at £20 each, would cost £2960; so that the additional cost of electricity would be £1718. If, however, they deducted the charges for capital and interest, the arc lamps would only cost £2368, or £1156 more than gas. That might have been expected to have been going far enough in the matter of cutting down the cost; but Mr. Mackenzie at that point brings out his new turning-down lamp, and at once the extra cost of electricity comes down by £600 or £700. It should be no effort to a genius like Mr. Mackenzie to explain away the whole difference at the next meeting of the Council.

Sulphate of ammonia is still rising in price—being now quoted at £13 15s. per ton for forward delivery.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 25.

Sulphate of Ammonia.—The market continues to advance. Spot parcels still remain within a narrow compass, and are, therefore, well competed for as they come on the market; there being a fair amount of prompt requirements. Consumers are slowly drawing supplies; being apparently afraid of buying too much at the enhanced prices. They are still hoping that the return to work of the English miners, and the dull state of the nitrate market, may ultimately cause sulphate values to ease off again. Meanwhile confidence in the future of the market is shown by the recent prospective sales at Leith—£13 15s. January-April, and £13 10s. May-September, having been paid. Prompt parcels are now quoted at £13 10s. to £13 15s., according to quality and time of delivery. The question of the total year's production as against last year, and the possible effect of the Scotch miners' strike, is exercising buyers' minds at present, and will have considerable bearing upon the future of the market.

LONDON, *Nov.* 25.

Tar Products.—The cessation of the great coal strike has made itself felt at once in the values of creosote and common tar oils. These are now all quotable at lower rates. Pitch is moderately firm; but the production, being very large, there is less urgency for deliveries. Benzols continue languid; and buyers seem indifferent. Solvent naphtha is brisk for spot consumption. Anthracene maintains its value; but no business of any importance is reported. Prices are as follows: Tar, 15s. to 16s. Pitch, 26s. to 27s. Benzol, 90's, 1s. 6d.; 50's, 1s. 7d. Creosote, 1¾d. Creosote salts, 25s. Solvent naphtha, 1s. 4d. Toluol, 1s. 8d. Crude benzol naphtha, 30 per cent., 8¼d. Carbolic acid, 60's, 1s. 7d.; crystals, 5¾d. Cresol, 1s. 4d. Anthracene, 30 per cent., "A," 1s. 2d.; "B," 10d.

Sulphate of Ammonia.—The price has fluctuated during the week between £13 to £13 10s., less 3¼ per cent., while there are buyers forward at a slight advance on these figures. Stocks in makers' hands are said to be extremely low; while the requirements of buyers are reported to be larger than usual. With the continued short shipments of nitrate, sulphate ought to not only hold its own, but see better prices. Gas liquor is offered at 8s. to 9s. 6d.

The Sanitary Condition of Florence.—Referring to the paragraph on this subject which appeared in the JOURNAL on the 7th inst., in which, on the authority of the correspondent of *The Times* in Rome, the water supply of Florence was stated to be inefficient, Dr. G. F. Yeo, F.R.S., writes to our contemporary from that city to the effect that the service is now adequate, and that the place is as free from "evil smells" as any Italian city he knows.

A Suggested Transfer of the Liverpool Gas-Works to the Corporation.—A lecture on the gas supply of the city was delivered last Thursday evening, at the Beaconsfield Club, Liverpool, by Mr. G. H. Ball, who advocated the control of the supply by the Corporation. Comparing Manchester with Liverpool, he said that the yield from gas in the former city was—taking it on the same basis as in Liverpool (3s. per 1000 cubic feet), and making an allowance of 2s. 1d. per ton for coal, to bring the gas up to the Liverpool illuminating power—£70,000 more than in Liverpool; and while in Manchester only 13s. 8d. per ton was paid for coal, no less than 18s. 8d. was paid in Liverpool. The lecturer also pointed out that, while in Manchester the highest salaries paid were £600 to the Chief Superintendent, and £500 to the Chief Engineer, in Liverpool no less an amount than £2000 a year was paid to the Chief Engineer, and £1000 to the Treasurer; the Board of Directors dividing a further £1300 among them. If the gas undertaking, including stocks and debentures, was taken over at the current market price—£2,661,100—the Corporation could borrow that amount for £78,834 interest per annum; and as the present amount of statutory dividend was £113,809, the ratepayers would benefit directly by such a change as he advocated to the extent of £33,975.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Most of the collieries throughout this district have during the past week got back into something like their ordinary work. Supplies from local collieries are now fairly plentiful in the market, and here and there collieries have been turning out more coal than they could immediately send away; but this is perhaps due largely to buyers holding back, in anticipation of some further modification in prices. With the resumption of work, there was a prompt and substantial reduction in prices—bringing round coal to within 4s. 6d. and 5s., the lower qualities of fuel to within 2s. 6d. and 3s. per ton of the prices ruling prior to the stoppage; but these are only temporary prices, and will no doubt be subject to further reduction. For the moment, pit prices average about 17s. 6d. to 18s. for the very best descriptions of round coal; 15s. to 16s. for second qualities; and 11s. up to 12s. 6d. and 13s. for common round coal. Burgy ranges from 10s. up to 11s.; and slack, from 8s. up to 9s. per ton at the pit-mouth, according to quality. At these rates, buyers have only been placing orders to cover pressing requirements; and during the course of the present week, it is not unlikely there will be a further giving way of about 2s. 6d. on round coals, and 1s. to 1s. 6d. on other descriptions of fuel.

Northern Coal Trade.—The fall in the price of coal has become more marked as the scarcity in the production is removed, and as the collieries in the Midlands increase their output. The effect in the North is to prevent a renewal of orders as contracts from the Midlands are completed. Especially is this the case with coals for locomotives. Many of the southern lines which have had to come to the North for supplies have now gone back to their local collieries; and thus a large amount of coal has been thrown on the northern market. The effect is not checked by the Scotch strike, and is seen in the fall in the price of coals generally. Best Northumbrian steam coals, which ten days ago were sold as high as 18s. 6d. per ton f.o.b., are now quoted at about 12s.; while second-class coals are 1s. per ton below that price. Small steam coals are quiet at about 5s. 6d. per ton; the demand for this kind of fuel having fallen off from the Midlands. Gas coals are now in very keen inquiry; and there are still considerable quantities sent inland, as gas companies desire to accumulate stock before the period of largest consumption. Prices for these coals vary more than any other class. Coals are being delivered largely, on old contracts, at about 6s. per ton; whilst in a few instances small lots are being delivered at as high as 13s. per ton f.o.b. The current price for gas coals for lots beyond contracts is difficult to quote; but perhaps 9s. a ton f.o.b. about represents a medium rate. A few days, however, may further bring down the rates for fuel, for they are tentative merely. Coke is not materially altered—the price for best Durham kinds being now about 15s. 6d. per ton, and the shipments being comparatively large from the Tyne, West Hartlepool, and the Tees. Gas coke is now in large production; but the sale for household purposes seems increasing. There is no alteration in price this week.

Scotch Coal Trade.—With the settlement of the strike in England, the trouble has simply been transferred to this side of the Border. The miners are on strike in some places in support of a demand for an advance of 1s. a day. The proposal is made that a fixed minimum wage of 7s. per day, and the appointment of a Conciliation Board, should be demanded. Some of the coalowners have granted the advance; but as yet there is no disposition apparent on the part of owners generally to give way. In consequence of this new development, prices, which went down a little in the beginning of the week, have again hardened. The strike is expected to be of short duration, as, with abundance of coal in the English market, prices will soon be low enough. Even though 1s. were granted just now, it, and perhaps more, would have to come off wages before the winter is over. It is generally admitted that the men are taking a false step. Prices are in such confusion that it is impossible yet to give quotations. The shipments amounted to 168,587 tons—a decrease when compared with the preceding six days of 28,955 tons, but an increase on the corresponding week of last year of 17,899 tons. For the year to date, the total shipments have been 7,009,114 tons—an increase on the quantity in the same period of last year of 139,453 tons.

Increase in the Price of Gas in Liverpool.—The Liverpool Gas Company have decided to raise the price of gas. It is stated that the increase will be 4d. per 1000 cubic feet, which will make the figure 3s. 4d. from the end of the present quarter.

Water-Works for Boughton.—An inquiry has recently been held by Major-General Phipps Carey, R.E., on behalf of the Local Government Board, relative to an application by the Faversham Rural Sanitary Authority, for sanction to borrow £2600 for the purpose of providing a water supply for Boughton. The scheme was opposed on the ground that the site was not suitable; but it was admitted that a fresh supply was required, and alternative sites were suggested.

Denton Local Board Gas Supply.—An inquiry was held at Denton last Thursday by Mr. F. H. Tulloch, respecting an application by the Local Board for the sanction of the Local Government Board to a loan of £1850 for gas-works purposes. The Clerk (Mr. J. Richards) stated that the gas-works were formerly managed by a Joint Committee, representing Dukinfield and Denton and Haughton; but in 1886 they built their own gas-works, and since then there had been a considerable increase in the make of gas, which was now about 22 million cubic feet per year. At the present time they had only the same retorts as in 1886; and, considering the augmented output, it was necessary they should have further producing powers, and it was for this purpose they made the application. On one occasion last year, the town was in darkness through the insufficient supply of gas; and, if nothing was done, the same thing would no doubt occur again. The sum they really required was £1950; but they had put it down at £1850—the extra £100 being for contingencies. It was also stated that the total make of gas per day was 350,000 cubic feet. In reply to the Inspector, Mr. Richards said the work had already been commenced.

The Chairmanship of the Leeds Corporation Gas Committee.—With regard to the difficulty which we stated last week had arisen in connection with this matter, Alderman Gilson has now waived his objections, and consented to occupy the position of Chairman of the Gas Committee for one more year.

Electric Lighting for Swansea.—The Swansea Corporation have delayed taking action under their Electric Lighting Order of 1889 as long as they possibly could; but they are now compelled to make a move. Several Companies have given notice of their intention to apply to the Board of Trade for power to supply electricity in the borough; and the Corporation have resolved to petition the Board not to sanction any Order, as they intend to at once enforce the provisions of their own Order.

The New Four-Lift Gasholder at Salford.—The four-lift gasholder, 150 feet in diameter, which the Whessoe Foundry Company, Limited, have lately completed for the Salford Corporation was used for the storeage of gas for the first time on the 19th inst. The work was started in the middle of March last; and the contract included cutting out the old two-lift holder, altering the stonework for the rest-stones, fixing new stones behind all the tank guides, and making the necessary changes in the timber-work for supporting the crown. It may be mentioned that the same Company have to supply all the fittings for the inclined retorts in the new house.

The London County Council and the Water Companies' Accounts.—At the meeting of the London County Council last Tuesday, the Water Committee reported that, under the provisions of section 37 of the Metropolis Water Act, 1891, every Metropolitan Water Company was required, on or before July 31 in each year, to furnish to the Council, among other authorities named in the section, a statement of account made up to the end of their financial year last past, in such form, and containing such particulars, as might from time to time be prescribed by the Board of Trade. They were of opinion that the entry of receipts from "water-rates" should be set out so as to give the following additional details: (1) The amount in respect of water supplied by meter for non-domestic purposes. (2) The amount in respect of water supplied by meter for domestic purposes. (3) The amount in respect of (*a*) high-pressure services, (*b*) baths, (*c*) water-closets, (*d*) garden supplies. (4) The amount in respect of water-rates levied upon a rental to be specified. They also suggested that the entry of amounts "written off as losses" should be set out so as to have the sums inserted opposite each of the three items now given in total—viz., empty houses, reductions in rental, and bad debts. These additions would make no difference in the form of the accounts; and the Committee recommended—"That the Clerk be instructed to write to the Local Government Board, suggesting that the Water Companies be required to furnish in their statements of account the additional information above specified." This was agreed to.

Causing Waste of Water.—At the Highgate Petty Sessions, on Monday last week, George Wilding, a servant of the Finchley Local Board, was summoned for aiding and abetting Isaac Edwards in tampering with a cock or valve belonging to the Barnet District Gas and Water Company. Mr. Bannister appeared for the Company, and stated that, but for the fact that this was not the first time they had had to complain, it was probable that no proceedings would have been taken. The Local Board were provided with keys for the purpose of obtaining water for flushing and other purposes; but defendant had no right to use that key. He appeared to have had some work to do, and employed a plumber named Edwards to do it; but as the water was on, Wilding procured a key, and the valve was turned off while the job was done, and then opened. The result was that the Company were informed, some days after, that the water in this road was short, and that damage had been done to the roadway. The Company's Engineer at once inquired into the matter, and found that the valve of a wash-out had been opened, and 230,000 gallons of water were wasted. This meant a loss of £10 to the Company. His clients had had to complain before; and he suggested that what had been done was with the consent of the Board. The full penalty was £5. Defendant said he thought the valve had been put right. Mr. Smythe, Engineer to the Local Board, said they knew nothing of the matter till a fortnight after the event, and would not countenance such a thing. They would take into consideration the defendant's conduct, which would in all probability lead to his dismissal. Mr. Bannister expressed a hope that this would not happen. The Bench fined the defendant the full penalty of £5, and 5s. 6d. costs.

Portsmouth Water-Works Company.—The half-yearly meeting of this Company was held last Thursday. The report which was submitted stated that there was an available balance on the profit and loss account of £16,703, from which the Directors recommended the payment of the full statutory dividends, which, after the usual deductions, would leave £2609 to be carried forward. During the half year 681 yards of new street service-pipes had been laid and 207 additional premises had been connected with the mains; the total number now being 35,162. The average daily supply of water had been 5,716,000 gallons. In moving the adoption of the report, the Chairman (Mr. W. Grant, J.P.) congratulated the shareholders on the fact that the water revenue for the six months was £1214 in excess of that for the corresponding period of 1892. On one day during the half year no less than 8,167,000 gallons of water were brought into the town within the twenty-four hours. The Board had given the question of waste full consideration; but their powers to deal with it were not what they should be, and it was possible they would have to ask the permission of the shareholders to take steps to get those powers increased. As to the failure of the negotiations with the Corporation for the transfer of the works, they did not care. They had not asked the Corporation to purchase them; and if they would not agree to pay a fair price, the Company were willing to keep the property, because they knew it was growing. The water-rental was increasing largely and steadily every half year, and had done so ever since the formation of the concern. It seemed, therefore, only reasonable to suppose that, if ever the property were taken over by the Corporation, the longer they waited, the more the Company would get for it. Colonel Lanyon Owen seconded the motion, which was unanimously adopted.

Chertsey Gas Company.—The unusual depression of the past year has only affected this Company in a small measure. It was feared that the unfavourable weather for the sale of gas, coupled with a reduction of 2d. in the price, and an extra expenditure on mains and services, would have resulted in a decreased revenue; but the Directors report that a fair share of trading has happily accrued. The Company have also been fortunate in respect to their coal contracts, under which they have been receiving a continuous supply. Dividends of 11½ per cent. on the original stock and 8½ per cent. on the new stock have been declared.

Large Sale of Gas Shares.—Messrs. G. A. Wilkinson and Son had a large company at the Mart last Wednesday, when they offered £20,000 of 7 per cent. consolidated stock in the *Brighton and Hove Gas Company*. It was put up in 200 lots, each of £100 of stock. The first were sold at £157 and £158 each; but there was a decline afterwards, and the final lots produced about £135 or £136 each. The amount of premium realized was £8291.——On the same day, Mr. Alfred Richards sold 15 shares of £10 each, paid up, in the *Enfield Gas Company* for £270; 12 "A" shares of £10 each, paid up, in the *Waltham Abbey Gas Company*, for £144; 50 shares of £5 each, paid up, in the *Woking Water and Gas Company*, for £200; 8 shares of £10 each, paid up, in the *Lea Bridge Gas Company*, for £160; and 5 shares of £10 each, paid up, in the *Colney Hatch Gas Company*, for £109.

Uttoxeter Water Supply.—The Uttoxeter Water-Works are now completed, so far as the Bramshall part of the scheme is concerned; and water is being supplied to consumers. A covered service reservoir to hold 150,000 gallons has been built. New mains have been laid throughout the town, and all the fittings connected with the old water-works have been tested, and replaced where found to be faulty. The total cost of the works has been £4792; and the extras on the general contract only amounted to £22 12s. 8d. So many persons asked for a supply of water during the construction of the works, that the Local Authority find themselves with an income of upwards of £400 a year on the completion of the works; and applications for water are still coming in. The scheme has, therefore, proved a great financial success. The Engineer (Mr. W. H. Radford, Assoc. M.Inst.C.E., of Nottingham) previously advised that the Bramshall Springs would not prove sufficient for the consumers; and the Local Authority have, therefore, decided to take steps to bring a further supply of water from the Somershall Springs—about 3½ miles from the town.

The Increase in the Price of Gas at Sheffield.—Our readers will remember that, as the result of the meeting of several large gas consumers at the Cutlers' Hall, Sheffield, a short time ago, a letter was written by Mr. C. F. Bennett to the Corporation, the Cutlers' Company, the Chamber of Commerce, the Tradesmen's Association, and the Federated Trades Council, asking them if they would join in a united deputation to the Gas Company, to endeavour to induce the Directors to reconsider the question of the increase in the price of gas, of which notice had been given. The matter was discussed at the last meeting of the City Council, and referred to the Parliamentary Committee (*ante*, p. 900), who said they "did not think it needful that the Council should appoint any deputation to wait upon the Company;" but that they relied upon the promise of the Company to revert to the former low rates at the first opportunity circumstances would allow. Mr. Bennett has received replies from the other bodies couched in such terms as to lead to the abandonment of the proposed deputation. It is stated, however, to be under discussion whether or not steps should be taken to obtain a public requisition to the Mayor, asking him to call a town's meeting to consider the question, or whether, now that the coal strike is at an end, and the price of coal likely to be very materially reduced, it would not be better to wait and see if any reduction in the charge for gas is made by the Company, in fulfilment of the promise naturally implied from their statement, that the increase was owing to the excessive cost of coal.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 979.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	16½—17½	..	6 0 0
100,000	10	,,	7½	Do. 7 p. c.	10	11⅛—12⅛	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	102—104	..	4 16 2
100,000	20	31 May	8	Bahia, Limited	20	10½—11⅛	..	13 18 3
200,000	5	15 Nov.	6½	Bombay, Limited	5	5⅛—5⅜	..	5 13 0
40,000	5	,,	6½	Do. New	4	3⅛—4⅛*	..	5 13 0
380,000	Stck.	16 Aug.	11½	Brentford Consolidated	100	220—225	..	5 2 2
180,000	,,	,,	8½	Do. New	100	163—168	..	5 1 2
220,000	20	15 Sept	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stck.	31 Aug.	5½	Bristol	100	102—105	..	4 15 3
320,000	20	29 Sept.	11½	British	20	42—44	..	5 4 7
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	6—7	..	2 17 2
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	98—101	..	5 18 10
150,000	20	13 July	8	Cagliari, Limited	20	27—28	..	5 14 3
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	244—249	..	5 0 4
165,000	,,	,,	9½	Do. New do.	100	187—192	..	4 19 0
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	230—235	..	5 10 7
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	191—196	..	5 2 0
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	185—290	..	5 5 3
486,090	10	28 July	10	European, Limited	10	21—22	..	4 10 1
354,060	10	,,	10	Do. Partly paid	7½	14½—15½	..	4 17 10
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	227—232	+2	5 3 5
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	97—102	..	5 18 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	263—268	..	3 14 7
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	120—125	..	4 0 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	185—190	..	3 18 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	173—178	..	3 18 7
463,000	,,	,,	10	Do. I, 10 p. c. Prf.	100	263—268	..	3 14 7
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	157—162	..	3 14 1
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	132—137	..	3 5 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	213—218*	+3	5 10 1
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	4⅞—5⅛	—⅛	5 14 3
560,000	100	2 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	105—107	..	4 13 5
541,920	20	15 Nov.	5	Monte Video, Limited	20	12¼—13½*	..	7 8 2
150,000	5	31 May	8†	Oriental, Limited	5	7—7¼	—¼	5 6 8
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4⅛	..	7 15 6
166,870	10	—	2	Pará Limited	10	1½—2	..	—
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	98—102	..	5 17 8
500,000	100	1 June	6	and Do.	100	98—102	..	5 17 8
150,000	10	13 Oct.	5	San Paulo, Limited	10	8½—9⅜	..	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	302—307	..	5 0 11
1,350,000	,,	,,	12	Do. B do.	100	242—247	..	4 17 2
260,000	,,	,,	13	Do. C do.	100	255—260	..	5 0 0
750,000	,,	13 July	5	Do. 5 p. c. Deb. Stk.	100	148—152	..	3 5 9
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
744,897	Stck.	29 June	10	Chelsea, Ordinary	100	270—275	..	3 12 9
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	208—213	—2	3 15 1
544,440	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	100	140—143	..	3 2 11
700,000	50	15 June	8½	Grand Junction	50	112—116	—1	3 13 4
708,000	Stck.	16 Aug.	11	Kent	100	284—289	..	3 16 1
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	100	242—247	..	3 16 11
406,200	100	,,	7½	Do. 7½ p. c. max.	100	199—204	..	3 13 6
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
500,000	100	16 Aug.	12½	New River, New Shares	100	335—340	..	3 11 4
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132—135	..	2 19 3
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10 p. c. max.	100	155—160	..	3 15 0
126,500	100	,,	6	Do. D 7½ p. c. do.	100	145—150	..	4 0 0
1,155,066	Stck.	15 June	10	West Middlesex	100	264—269	+2	3 14 4

*Ex Div.

† Next dividend will be at this rate.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO.,

TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

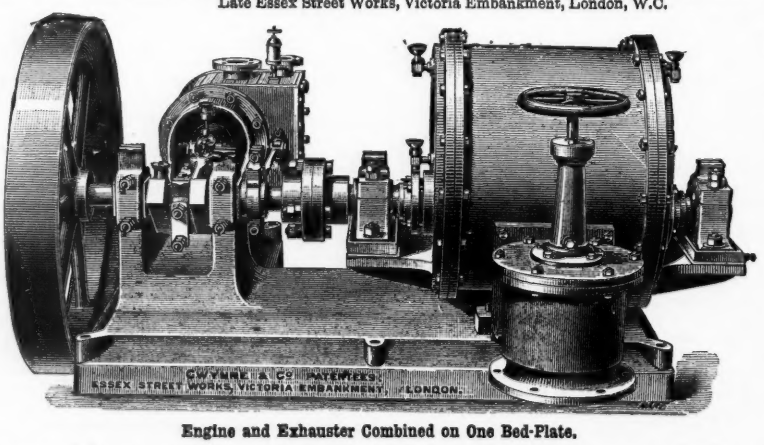
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

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Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
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JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

G. L. LAMBERT, 26, Alberta Terrace, Nottingham. Consultations, Advice, Reports in Various Branches of **Practical** Mechanical Engineering and Machinery. **Specialities** in Water, Sewage, and Gas Plant Making. **Surveyor** of Steam-Ships, Marine Engines, Boilers, and General Machinery. **Detailed Inspection** of Engineering Contracts during Manufacturing and Erection.

YOUNG Man (age 23) seeks Situation as CLERK or COLLECTOR in a Gas Company. Six years' experience. Highest references.
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WANTED, by a competent Man, a Situation as SERVICE LAYER, METER FITTER, INDICE READER, STOVE FITTER, &c. Total abstainer.
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WANTED, a Situation as Working Gas Manager, used to Engine and Exhauster. Can use all Tar made for firing Retorts, lay Mains and Services, fix Meters, take Indices, and do his own Mechanical Repairs upon the Works.
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WANTED, by a young Man (age 23), a Situation as ASSISTANT in a medium-sized Gas-Works. Five years' experience in modern Works (Regenerator Furnaces). Well up in Photometer work and Testing of every kind. Honours in Advanced Grade, City and Guilds of London Examination in Gas Manufacture.
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ADVERTISER desires a Situation as WORKING FOREMAN. Has had considerable experience in Constructing, Erecting, and Supervision; and thoroughly understands the routine of Gas-Works throughout. Has acquired thorough knowledge of the most modern methods in Carbonizing, Gas Purification, and Distribution.
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WANTED, an Assistant Engineer for a large Gas-Works in the North of Italy.
Applications, stating qualifications, age, &c., to be addressed to H. W. F., care of Housekeeper, 7, Drapers' Gardens, LONDON, E.C.

WANTED, for a Provincial Gas and Water Company, a Young Man, accustomed to Gas-Fitting and taking Meter Indices. Permanent job for a steady suitable person.
Apply, with copies of testimonials, to No. 2304, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Two or Three Travellers with undoubted connections with Gas Companies. Say in what part of England connection exists, and Salary required.
Apply, by letter, stating experience and full particulars, to No. 2305, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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(GAS DEPARTMENT.)

WANTED, a thoroughly practical GAS-FITTER.
Apply, stating age, experience, whether married or single, and wages required, to G. HELPS, Engineer and Manager.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
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Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. IV., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
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WANTED, a Smith and Gas-Fitter. Must be well up in Compo. and Iron Work. One used to the general routine of Gas-Works preferred.
Apply to FRANK OSMOND, Manager, Gas-Works, DORCHESTER.

WORKSHOP Manager wanted. Energetic and enterprising man, acquainted with Gas Apparatus from the Retort to the Burner, good Draughtsman and Correspondent, and able to design new Apparatus.
Applications (which will be held as strictly confidential) must contain brief particulars as to experience, present occupation, salary, and age.
Address Box 1660, Sell's Advertising Offices, LONDON.

BRADFORD CORPORATION WATER-WORKS.

TO CONTRACTORS.

CONTRACT NO. 2.—NIDD AQUEDUCT.

THE Corporation of Bradford invite TENDERS for the CONSTRUCTION and MAINTENANCE for Twelve Months after Completion of a MAIN AQUEDUCT from the River Nidd to Chellow Heights, Bradford, a distance of 31¼ miles or thereabouts; BRANCH AQUEDUCTS extending to 5¼ miles or thereabouts in length, situate at various places on the line of the Works; also DAMS, INTAKES, WEIRS, BRIDGES, CHAMBERS, and other collateral Works.

The Works will comprise:—
1—5¾ Miles of Main Aqueduct in Tunnel.
2—11¾ Miles of Main Aqueduct in Cut-and-Cover.
3—14 Miles of Main Aqueduct Trenches, and Laying and Jointing Cast-Iron and Steel Pipes, 36 inches diameter.
4—5¾ Miles of Branch Aqueducts and Pipe-Lines 30 inches to 6 inches diameter.
5—Masonry, Dams, and Weirs at various Streams.
6—Bridges over the River Wharfe, Leeds and Liverpool Canal, River Aire, and other Streams.
7—Culvert under the Midland Railway, and Steel Girder Bridge near Bolton Abbey Station.
8—Measuring, Air, Scour, and other Chambers.

The Work is scheduled in six sections; and the Corporation reserve the power to let each section to separate Contractors, or to let a number of such sections, or the whole to one Contractor, and Contractors may tender for any one or more of the sections, or for them all.

The Drawings and Specification of Works may be seen, and copy of the Specification, with Conditions, Bill of Quantities, and Form of Tender, including outline Plan and Section, and reduced Drawings of the more important parts of the Work, may be obtained at the Office of Mr. James Watson, M.Inst.C.E., the Corporation Water-Works Engineer, Town Hall, Bradford, on and after Monday, the 13th inst., on payment of Five Guineas, which sum will be returned in full as soon as practicable after the receipt of a *bonâ-fide* Tender with the Bill of Quantities and Schedule fully priced out, accompanied by the Specification and Drawings attached.

An Assistant Engineer will meet intending Contractors at Pateley Bridge Station on Thursday, the 16th inst., Tuesday, the 28th inst., Wednesday, the 6th of December, and Thursday, the 14th of December next, at Ten a.m. each day, to show them over the site of the Works.

Sealed tenders, endorsed "Tender for Nidd Aqueduct," to be sent to the Town Clerk, at the under-named Office, not later than Friday, the 22nd of December next.

An assurance must be given by each Contractor that he pays to the workmen employed by him not less than the minimum standard rate of wages.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
W. T. M'GOWEN,
Town Clerk.

Town Clerk's Office, Town Hall, Bradford,
Nov. 8, 1893.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
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FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

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LIQUOR, Tar, and Spent Oxide wanted. BROTHERTON AND Co., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

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PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

WANTED, to purchase, for immediate delivery, 300 to 400 tons of SPENT OXIDE, containing from 50 per cent. to 60 per cent. of Sulphur.
Apply, by letter, to No. 2306, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Four Gas-Purifiers, each 16 ft. by 8 ft. by 3 ft. 6 in. deep, with Covers and Lifting Apparatus. Cheap.
Apply to ANDREWS AND BABY, East Moors, CARDIFF.

MIDLAND RAILWAY COMPANY.

THE Directors of the Midland Railway Company are prepared to receive TENDERS for the purchase of the surplus HYDROCARBON and OIL-GAS TAR produced at their Oil-Gas Works, Kentish Town (London), Bristol, Birmingham, Leeds, and Manningham during 1894.
Forms of Tender (for consideration on Dec. 14, 1893) may be had on application to Mr. PETTIFOR, General Stores Department, Midland Railway, DERBY.

LEA BRIDGE DISTRICT GAS COMPANY.

BY ORDER OF THE DIRECTORS.

Sale of 300 £10 Shares, part of the further additional Share Capital authorized by the Lea Bridge Gas Act, 1878, and ranking for a Dividend of 7 per cent. per annum, with increase or decrease under the usual Parliamentary Sliding-Scale Clauses.

MR. ALFRED RICHARDS will sell the above BY AUCTION at the Mart, E.C., on Wednesday, Dec. 6, 1893, at One for Two precisely, in lots.
Particulars may be obtained at the COMPANY'S OFFICES, 3, Jeffrey's Square, ST. MARY AXE, E.C., and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

BROMLEY GAS CONSUMERS' COMPANY.

SALE BY TENDER OF £3500 FOUR PER CENT. MORTGAGE DEBENTURES

In sums of £100 or multiples thereof, to be issued the 31st of December, 1893, and paid off at par on the 31st of December, 1903. Minimum price, at the rate of £105 per cent. of the amount of each Debenture.

THE Directors invite Tenders for the above-mentioned MORTGAGE DEBENTURES, to be sent to me before Eleven o'clock on the Morning of Thursday, the 14th of December, 1893.
All tenders must be made in the form provided by the Company, which, together with printed Particulars and Conditions of Tender, can be obtained on application to me at the Company's Offices, Homesdale Road Bromley, Kent.

By order,
HENRY W. AMOS,
Secretary.

Nov. 14, 1893

Now Ready, Cloth Bound, Price 3s. 6d., Post Free,

THE ROYAL COMMISSION on the METROPOLITAN WATER SUPPLY.

— 1892-3. —

Report of the Evidence (reprinted from the JOURNAL), with Comments on the Inquiry, and the Commissioners' Conclusions and Recommendations.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

BAHIA GAS COMPANY, LIMITED.

NOTICE is hereby given, that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the Company's Offices, 9, Queen Street Place, Cannon Street, London, E.C., on Thursday, the 30th day of November, 1893, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, and for General Purposes.

The chair will be taken at Three o'clock precisely.

The Transfer Books are closed from the 16th to the 30th inst., inclusive.

By order of the Board,
THOMAS GUYATT,
Secretary.

Nov. 16, 1893.

EAST LONDON WATER-WORKS COMPANY.

ISSUE OF NEW CAPITAL.

NOTICE is hereby given, that the Directors are prepared to receive TENDERS for £35,000, being the sixth and final portion of the NEW PERPETUAL DEBENTURE STOCK of the Company, to bear Interest at 4½ per cent. per annum, free of Income-Tax, such Tenders to be delivered at the Company's Offices, St. Helen's Place, in the City of London, not later than Eleven o'clock, a.m., on the 14th day of December, 1893, and payment of accepted Tenders made on the 22nd of December.

Particulars and Conditions, together with Form of Tender, may be obtained at the said Offices, or will be forwarded on application.

By order of the Court of Directors,
ISAAC ADOLPHUS CROOKENDEN,
Secretary.

St. Helen's Place, London,
Nov. 4, 1893.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is hereby given, that Charles Lloyd Braithwaite, Junior, and Isaac Braithwaite, both of Kendal, Co. Westmoreland, have applied for leave to AMEND THE SPECIFICATION of the Letters Patent No. 8301 of 1887, for "Improvements in, or applicable to, Atmospheric Gas-Burners, and to other Articles Requiring Free Circulation of Gaseous Matter while preventing the passage of Flame."

Particulars of the proposed Amendments were set forth in the "Illustrated Official Journal (Patents)" issued on the 22nd of November, 1893.

Any person or persons may give notice (on Form G), at the Patent Office, 25, Southampton Buildings, London, W.C., of opposition to the Amendment within one calendar month from the date of the said Journal.

(Signed) H. READER LACK,
Comptroller General.

W. P. Thompson and Co.,
Patent Agents,
Manchester, Liverpool, and London,
Agents for Messrs. Braithwaite and Son.

PUBLICATIONS

ISSUED BY

WALTER KING,

11, BOLT COURT, FLEET STREET, LONDON, E.C.

ALL PARCELS SENT CARRIAGE FREE.

HANDBOOK FOR GAS ENGINEERS AND MANAGERS. — By THOMAS NEWBIGGING, M.Inst.C.E. Fifth Edition, enlarged, and illustrated by 193 engravings. Prices: Bound in morocco, gilt edges, 18/-; cloth, 15/-.

PRACTICAL PHOTOMETRY: A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.—By W. J. DIBDIN, F.I.C., F.C.S., Chemist and Superintending Gas Examiner to the London County Council. Price 7/6, cloth, bevelled boards.

THE TRANSPORT OF MATERIAL FOR GAS-WORKS, ILLUSTRATED BY PLANS OF THE YORK, NEWCASTLE-UPON-TYNE, AND BECKTON GAS-WORKS.—By V. WYATT, formerly Constructing Engineer to The Gaslight and Coke Company. Price, in paper cover, fcap. folio, 2/6.

KING'S TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.—Edited by THOMAS NEWBIGGING, M.Inst.C.E., and (the late) W. T. FEWTRELL, F.C.S. In three volumes, royal 8vo., half-bound morocco, cloth sides, gilt edges and lettered, price £4 4s. Separate volumes may be had, price 28/- each

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OF THE

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Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the year ended December 31, 1892, or March 31, 1893, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the year ended December 31, 1892.

Compiled and arranged by

ALFRED LASS, F.C.A.

LONDON:

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

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OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

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Samples and Prices on application.

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Established 1872.

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AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works

(also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

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WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	PER CENT.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE' NEWCASTLE-ON-TYNE.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,

15, HANOVER STREET,

EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1½ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

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CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

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56, ROBERTSON STREET, GLASGOW

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

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BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

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IRISH OXIDE OF IRON.

GAS PURIFICATION.

RIKY'S OXIDE (formerly worked by Messrs. Stanley and Olphert).

THE LARGEST SUPPLY OF OXIDE IN HAND OF ANY OTHER FIRM IN THE WORLD.

Purity and Uniformity of Quality Guaranteed.

RIKY AND CO. can supply the above at a much lower rate than any other firm in the trade, being owners of the property where it is found. *No Middleman* or *Agent* receives a profit.

SAMPLE AND PRICE ON APPLICATION.

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To pass 300,000 Cubic Feet per Hour, with or without Engine combined.

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Illuminating Power . . . . . 16·4 candles.
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W. RICHARDSON, Fitter.

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MANUFACTURE
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FOR GAS-FURNACES.

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These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

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Yield of Gas per ton . . . . . 13,155 cub. ft.
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Coke per ton . . . . . 1,301·68 lbs.

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Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
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Yield of Gas per ton . . . . . 10,500 cub. ft.
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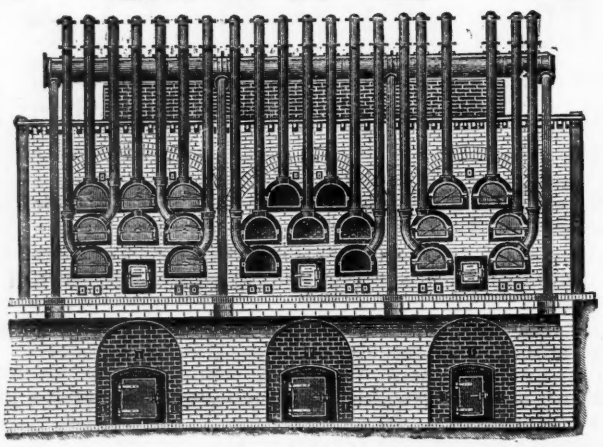

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REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S, VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

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DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

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Gasholders and Gas Plant

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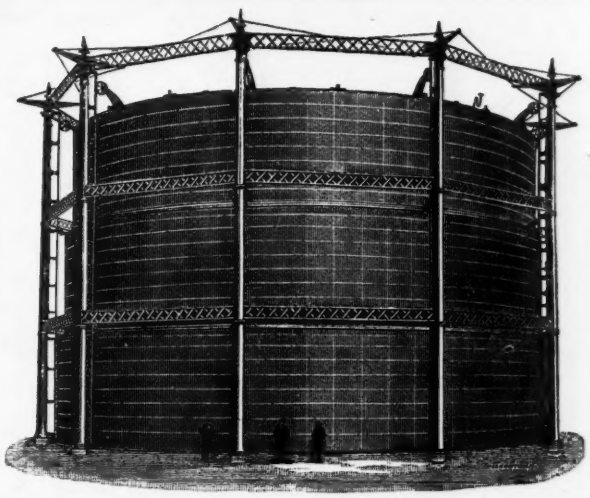
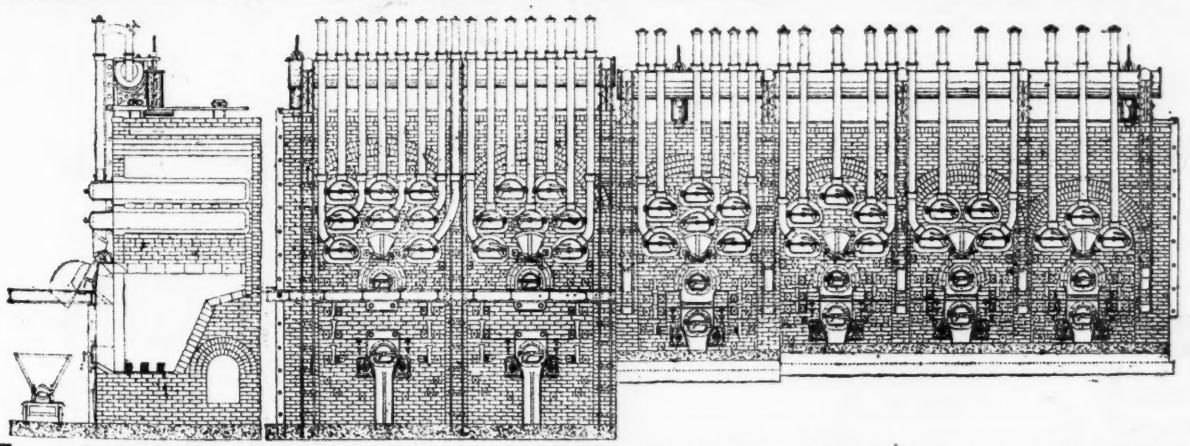


Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.

Telegraphic Address: "Donald Paisley."

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

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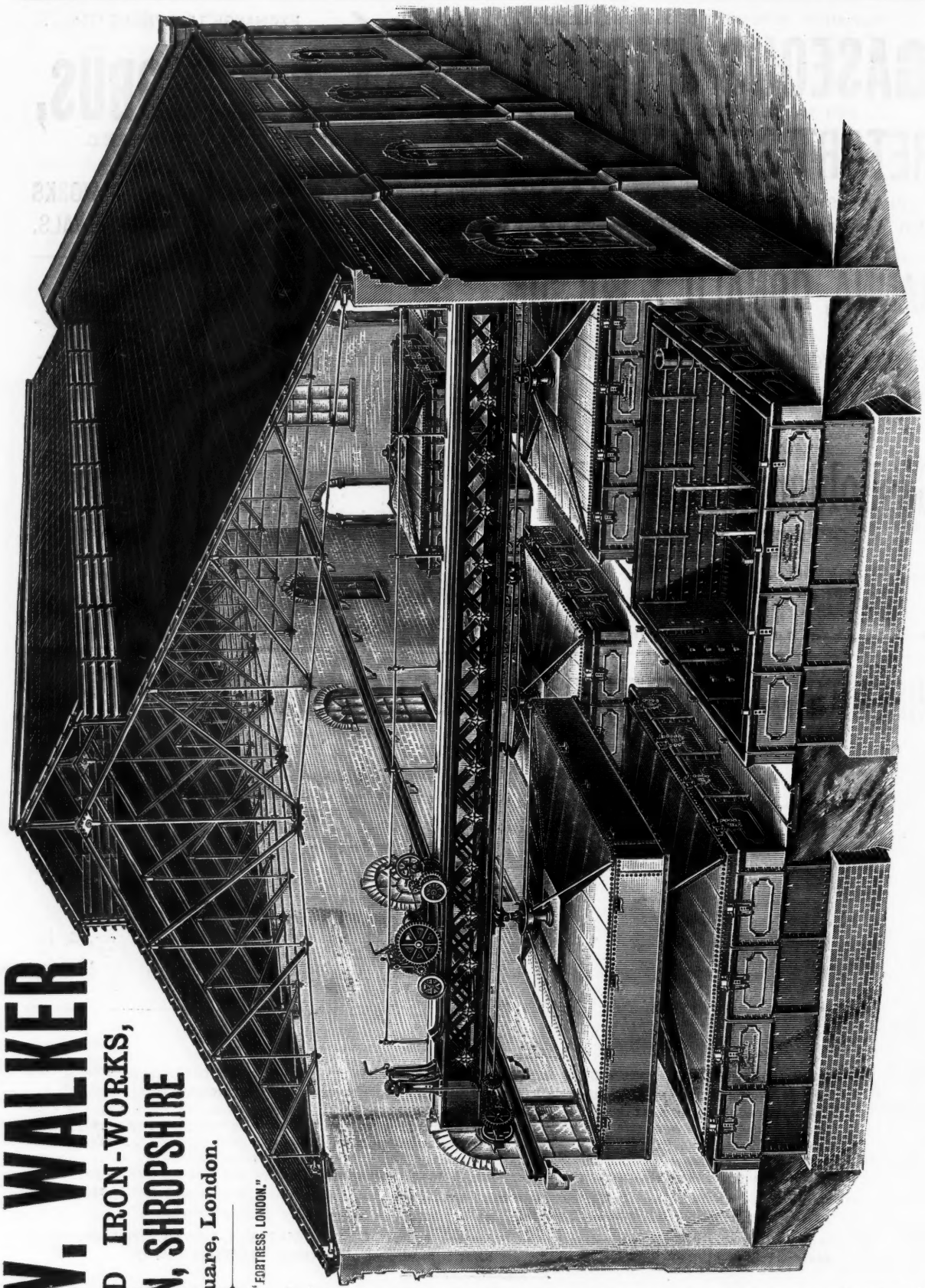

THE ABOVE ENGRAVING IS A SET OF PURIFIERS AS ERECTED. THEY ARE MADE WITH **ALL MODES OF LIFTING APPARATUS**—HYDRAULIC OR OTHER POWER—WITH OUR **IMPROVED ELEVATORS**, AND ARE WORKED **WITH ALL DESCRIPTIONS OF VALVES**, AND TO SUIT ALL SITUATIONS AND REQUIREMENTS.

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OF WHICH

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THEY HAVE ERECTED THEM IN LARGE NUMBERS and of the GREATEST MAGNITUDE THROUGHOUT the UNITED KINGDOM, and in all PARTS of the WORLD; and they are UNIVERSALLY ADMITTED to be the BEST and STRONGEST OF ALL PURIFIERS, and the MOST MODERATE in COST.

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Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

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2. They can be made in one piece up to 10 feet long.
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MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

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CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

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Sulphate of Ammonia Apparatus.

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RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

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THE LARGEST GASHOLDER IN THE WORLD.

CAPACITY 12 MILLION CUBIC FT.

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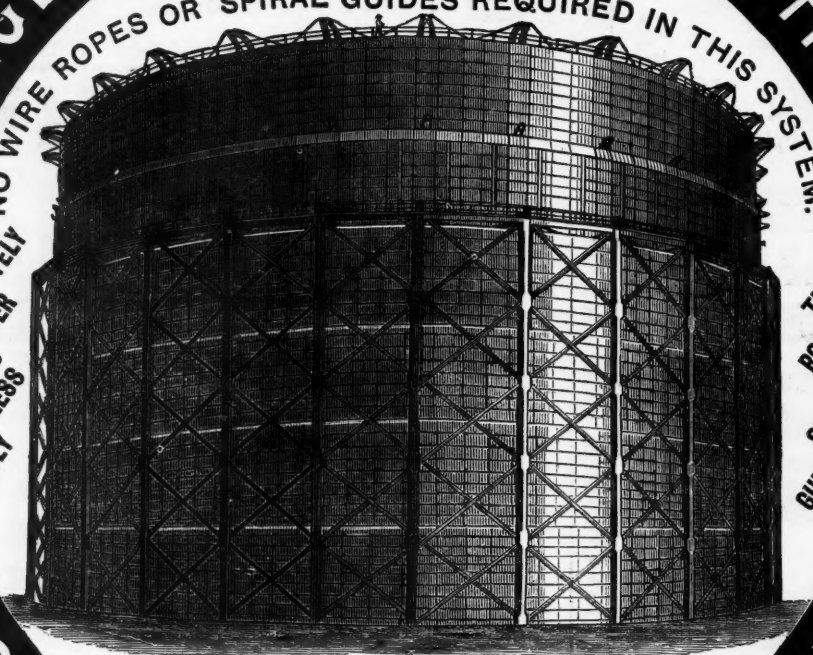
NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.

INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.



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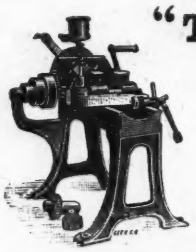

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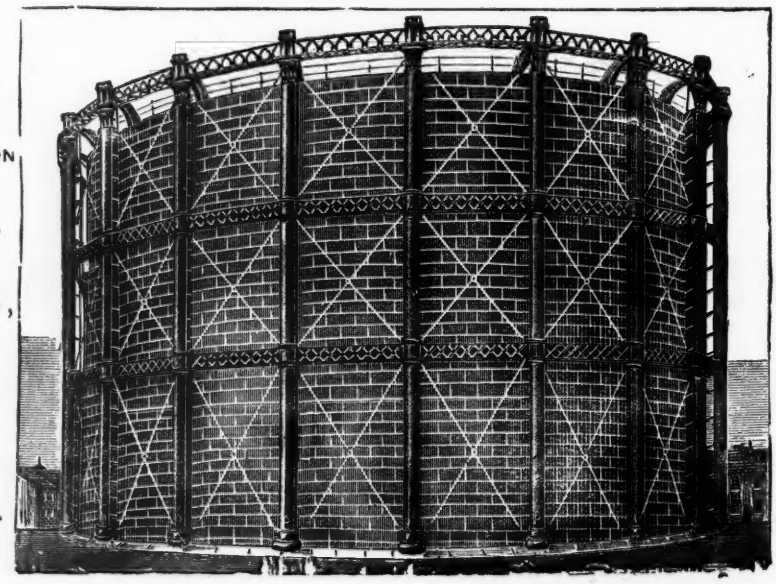

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A 280-CANDLE POWER PLAIN IRON LAMP,

CLASS A— 55/-

LIGHT for LIGHT less than half the price of any other Regenerative Lamp.

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See Illustrated Advertisement, p. II. Centre of JOURNAL for Nov. 7.

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Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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TWO GOLD MEDALS.

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Several New Patterns are being introduced, combining those qualities for which we have so high a reputation.

FIRST-CLASS FINISH.

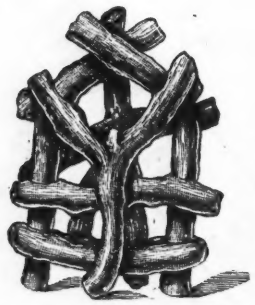
HIGHEST HEATING POWER.

ELEGANCE and ECONOMY.

THE "PARKINSON" GAS-FIRE.

Massive and Brilliant. 13-inch Fire Front.

A Grand Stove at a Very Moderate Price.



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PARKINSON'S NEW PATTERN GAS-FIRE FUEL

Is made by a Patent Process, and is an improvement on any Fuel of the kind hitherto made. It produces a Fire of intense heat and radiancy, and does not choke the flame.

Send for Parkinson's New Stove Catalogue.

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10, MAWSON'S CHAMBERS, DEANSGATE, **MANCHESTER.** Telegraphic Address: "PRECISION."

[See also Advt., p. 974.

London: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Nov. 28, 1893.